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DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

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LOWELL EVENING TEXTILE SCHOOL

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1937.

September 23, Thursday	Registration.
September 30, Thursday	Registration.
October 4, Monday	Opening of evening school.
October 12, Tuesday	Columbus Day—Holiday.

November 11, Thursday	Armistice Day—Holiday.
November 25, Thursday } November 26, Friday . }	Thanksgiving recess. No classes.
December 17, Friday	End of first term.

1938.

January 3, Monday	Opening of second term.
February 22, Tuesday	Washington's Birthday—Holiday.
March 11, Friday	Closing of evening school.
April 6, Thursday	Graduation.

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

The course in Organization, which is offered only to those who have completed the work in Carding and Spinning, is a relatively new course given in response to a demand for this type of instruction.

110. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made.

Two evenings each week.

Cotton.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cottons desired and securing delivery at a known price.

Opening and Picking.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, spooling, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

Roving.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

Ring Spinning.—A study of the various types of yarns gives the student an appreciation of the necessary charasteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studied in detail. Important machine parts, such as rings, builders, guides and travelers, their adjustment and care form an important part of this subject. Yarn faults and defects are shown and their causes explained.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

114. Cotton Organization—1 Year.

The course in Organization is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative

problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

211. Woolen Yarns—1 Year.

Instruction consists of lectures on technology of wool fiber (for detailed description see Course 212) and woolen yarn manufacture. This covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Reworked fiber (shoddy) is covered in detail from rag sorting to finished staple.

Three evenings each week.

212. Wool and Top Making—1 Year.

Instruction consists of lectures in technology of wool fibers, worsted carding and combing, and mechanism and calculations.

TECHNOLOGY OF WOOL FIBRES—*one evening each week.*

RAW MATERIALS.—The study of raw materials which enter into the manufacture of woolen or worsted yarns or hardened felts, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel hair, cut staple rayon, etc. In connection with these are considered shoddy, noils, and extracts.

WOOL SORTING.—Familiarity with the various grades and kinds of wool is obtained by lectures. The various characteristics and properties are explained, as are also trade terms, such as Fine, ½-blood, ⅜-blood, 56^s, 36^s, B super, delaine, braid, etc. Over 1,500 samples of wool and other fibers gathered from all the countries of the world are catalogued and are available for inspection and study. Wool shrinkages are studied as are also spinning qualities. A complete collection of literature pertaining to sheep, wool, etc. is available for outside reading or study.

WOOL SCOURING.—The objects of scouring or degreasing and the methods employed are explained. This involves the consideration of soaps and chemicals used in scouring and degreasing, also the waste products and their utilization. A sorted lot of grease wool is scoured by machines that are made similar in operation to regular commercial wool scouring machines. At the same time the use of driers, their operation and regulation, is taken up.

CARBONIZING.—The methods of carbonizing wool, noils, burr waste, rags, etc. are studied. If time permits, a commercial quantity of stock is carbonized on the regulation carbonizing machines in the wool laboratory.

WORSTED CARDING AND COMBING—*one evening each week.*

CARDING.—The different types of worsted cards are studied in detail, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application, grinding, setting, etc.

COMBING.—This branch takes up the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and Noble comb is studied by lectures. Two Noble combs are available for inspection and study.

MECHANISM AND CALCULATIONS—*one evening each week.*

This subject gives the principles of the various mechanisms used in wool manufacturing machines. Among the topics dealt with are—equations, surface speed, R. P. M., drivers, drivens, draft and production calculations, stop motions, combing layouts, levers, logarithms, top testing, calculations, etc.

213. Worsted Yarns—1 Year.

Instruction is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule or frame. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quiltings, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313. Decorative Art—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings each week.

During the *second year* instruction is given in color harmony—a study of true color and the variety of effects obtainable.

Two evenings each week.

In the *third year* the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.
2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Two evenings each week.

314. Advertising Design—2 Years.

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

Show Card Design—The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium

mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

LANGUAGE DEPARTMENT

510. English Composition—2 Years.

Remedial English and Rhetoric—*First year.* Parts I and II. In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles.

The following subjects are studied: The eight parts of speech—characteristics and use of each; the kinds and the structure of sentences; punctuation; the building

up of the paragraph; the principles of composition; description, exposition, narration, argumentation, and letter writing; study of difficult words; and selections from various authors to be read for general interest and for the purposes of illustration.

10 assignments in each part with an examination at the end of each part.

One evening each week.

Problems in the Interpretation and the Appreciation of Literature—*Second year.*—This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

Two evenings per week.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

Two evenings each week.

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horse-power, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires home problem work and the study of a text book.

Two evenings each week.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

Two evenings each week.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

Two evenings each week.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

Two evenings each week.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. A considerable amount of home study and preparation is required. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

Two evenings each week.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work.

Two evenings each week.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated. A text book is required.

Two evenings each week.

626. Mill Illumination—1 Year.

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

Two evenings each week.

628. Selling and Advertising—1 Year.

This course covers the basic principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

Two evenings each week.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears, gearing, cams and similar topics. Home problem work and the study of a text book are required.

Two evenings each week.

631. Plane Geometry—2 Years.

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

Two evenings each week.

632. Diesel Engines—1 Year.

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

Two evenings each week.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the

main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1937.

Certificates awarded as follows, April 1, 1937:

Cotton Yarns—2 Years.

John Burton Austin	Reading
Anthony Henry Devaney	Lowell

Knitting—1 Year.

William Ball	Methuen
John Christison	Methuen
Frederick Nelson Dickey	Lowell
John Brown Hunter	Chelmsford

Woolen Yarns—2 Years.

Frank David Carroll, Jr.	Lowell
Richard Hubbard Cook	Lowell
Max Cooperstein	Malden
George William Daley	Haverhill
Oliver Damon	North Billerica
John Ollier Darlington, Jr.	Methuen
Joseph Thomas Fox	North Andover
Bert Gilbert	Methuen
Harvey Arthur Joyal	Lowell
Christopher Lawrence Muller	Andover
Thomas Bernard Murray	Lawrence
Benjamin Franklin Savage, Jr.	Lowell
Alexander Soucey	Lawrence
Edward Lee Spaulding	Billerica
Robert Griffin Thompson	Haverhill
Alexander Vervaert	Lowell
Fred Whitaker	Andover
Harold Robb Wilcox	Maynard

Worsted Yarns—2 Years.

George Sykes Archer	Lowell
Frank Salvatore Cefalu	Lawrence
John Milton Cole	Methuen
Leslie Frank Currier	Lowell
Edwin Cragin Deming	Lawrence
James DiLavore	Methuen
James Woodrow Donovan	Lawrence
Bruno Stanley Dzioba	Lawrence
Anthony Frank Fallisi	Lawrence
James George Hetherington	Methuen
John Holden	Lawrence
Ralph Smith Howard	Methuen
Joseph Hugh Keenan	Lawrence
Arthur Long	Methuen
William Matal	Lawrence
Lawrence Robinson Poole	Methuen
Millage Stennett Rawnsley	Lowell
Peter Sechovich	Forge Village
John Hollywood Shinner	Methuen

Cotton Design—3 Years.

Joseph Wilfred Gionet	Shirley
Lucien Johnston Harmon	Lowell
William Nathaniel Hunt	Lowell
Ralph Stanton Pushor	Lowell

Woolen and Worsted Design—3 Years.

Joseph Linwood Allen, Jr.	Methuen
Chester Arthur Brown	Lowell
Leslie Newell Center	Wilton, N. H.
Otis Edmund Fairfield	Wilton, N. H.
Joseph Leo FitzGerald	Milford, N. H.
John Fraser Giffin	Wilton, N. H.
Alfred Greenfield, Jr.	Andover
Wallace Hall	Lawrence
Frederick Richard Holt	North Andover
Walter Augustine Jackson	Methuen

Julius James Karacieus, Jr.	Lawrence
Raymond Maxime Lafortune	Lowell
Romeo David Legare	North Andover
William Paul McCarthy	Lowell
John Nauiokas	Lawrence
Evariste Joseph Pepin	Lowell
Wallace Rennie	North Andover
William Maxwell Thomson	Lawrence
Noble Wright	Lawrence

Advertising Design—2 Years.

Cyril Andrew Gordon	Lowell
Henry Adoulf Hansen	Lowell
Mary Mabel Higgins	Lowell
George Gladstone Pardoe	Lowell
Bernard Joseph Ready	Lowell
Arthur Warren Stancombe	Lowell
Elias Stavropulos	Lowell

Decorative Art—3 Years.

George Elbert Bowring	Lowell
John Francis Dowling	Lowell
Alice Foye McCarthy	Lowell
Beatrice Veracunda Newhall	Lowell
Roswell Thomas Wallwork	Lowell

Cotton Weaving—1 Year.

Christos Anganes	Lowell
Arthur Dinis Boucher	Lowell
Leo Thomas Fortier	Lowell
Alexandria Ann Koroski	Lowell
Charles Tzikopoulos	Lowell
Frederick Ernest Whitehouse	Tewksbury

Loom Fixing—1 Year.

Norbert Joseph Aubin	Lawrence
Joseph Boothroyd	Maynard
Victor Brouillette	Lowell
Roland William Dumais	Nashua, N. H.
Walter Henry Graichen	Methuen
Stanley Joseph Krysiak	Lowell
George Henry Matthews	Lowell
Joseph Edward Michalewicz	Lawrence
Robert Mills	Methuen
Adelard St. Amand	Lowell
Sylvester Arthur Thomas	Shirley
Herbert Empsel Willman	Lowell

Woolen and Worsted Weaving—1 Year.

Anthony John Bush	Lawrence
Ralph Collinson	Methuen
Norman Francis Farah	Lowell
James Peter Farrah	Lowell
Joseph Andre Gagnon	Lowell
Leo Henry Gelineau	Lowell
Alfred Gendron	Lowell
Albert Guerin	Lawrence
Frank William Henry	Lowell
Ross Merrill Howes	Lawrence
Thomas Kady	Methuen
Thomas George Kibildis	Lawrence
Thomas Frederick LeLacheur	Lowell
Aubrey Oland Lightfoot	Lowell
John Joseph McHugh	Lowell
Maurice Roland Marchand	Lowell
Malcolm Murphy	Andover
Richard Holden Olney	Lowell
Frank Neil Piessens	Lawrence
Charles Henry Redman	Lowell
Alonzo Flavian Roy	Lawrence
Wilfred Roy	Lawrence

Albert Stravinskas	Methuen
Hipalit Warren Szuflicki	Lawrence
Alexander Edward Thurber	East Chelmsford
Stanley Warchot	Lawrence
Toivo Aimas Wick	Maynard

Woolen and Worsted Finishing—1 Year.

Charles Peter Averka	Lawrence
Hollis Goodenow Barlow	Maynard
Lester Raymond Barrington	Billerica
James Leo Batts, Jr.	Methuen
Hubert Joseph Beaumier	Lowell
Ernest Augustus Borden	Bradford
George Edward Buckley	Lowell
Arthur Bernard Charlesworth	Methuen
Rufus Edward Corlew	Lowell
Arthur James Flanagan	North Andover
William Dixon Glennie	North Andover
Warren Cleveland Hall	Andover
Wilfred Sidney Laporte	Lowell
Laban Ewart McComish	North Andover
Walter Stoddart MacLauchlan	Methuen
Thomas Marsden	Maynard
Dennis Joseph Murphy	Lowell
E. Geoffrey Nathan	Brookline
Charles Thomas Neild	Lowell
George Washington Pihl	Lowell
Seward Proctor	Lowell
John Arnold Ratcliffe	North Andover
Benjamin Booth Ross	Lawrence
Joseph Francis Ryan	Lawrence
Howard Sherlock	Methuen
John Miller Shields, Jr.	Lawrence
George Olney Steere	Methuen
Ernest Asa Stocks	Andover
Frank DeWitt Tallmadge	Methuen
Carl Arthur Thomas	North Andover
William Joseph Viel	Lawrence
Alden Robert Walls	Andover

Textile Chemistry and Dyeing—3 Years.

Simon Bachner	Roxbury
Otis Caton Gorman	Nashua, N. H.
George Augustine Molloy	Lawrence
William Alexander Page	Andover
Harry Richardson	Lawrence
Isaakas Sapirsteinas	Brookline

Analytical Chemistry—3 Years.

Edward Herbert Ryan	Lowell

Elementary Chemistry—2 Years.

Walter Akam	Methuen
Gordon Barber	Lawrence
Robert Francis Bastow	North Billerica
Joseph Harper Binns	North Andover
Harry Robert Buckley	Methuen
Fred Arthur Buthmann	Lawrence
Edward Camara	Lowell
Frederick David Clement	Lowell
Raymond Arthur Flanders	Methuen
Robert William Ginivan	Lowell
Frank Parker Hatch	Haverhill
Joseph Warren Hogan	Lowell
Mildred Josephine Holmes	Lowell
Maurice Jones	Methuen
Hamilton Tillman McClay	Mattapan
Allan Cleveland Milnes	Andover
Gerard Charles Morel	Lawrence
Francis Elmer Mosher	Lawrence
Daniel Dominic Murphy	Lowell

Clare William Norton, Jr.	Andover
David Barlow Parker	Lawrence
Armand Joseph Patenaude	Lowell
Harry Woolley Pratt	Lawrence
Norman Eric Roberts	Lawrence
Cornelia Anne Rodopoulos	Lowell
Edward Saba	Lowell
Thomas Joseph Scanlon	Lawrence
Alfred Walter Scheer	Nashua, N. H.
Earl Frederick Schubert	Methuen
Albert Lester Sugden	Methuen
Louise Anna Rose Sullivan	Tewksbury
Chester Volney Sweatt	Westford
William Peter Tsaffaras	Lowell
Benjamin Wolff	Lowell
Walter Joseph Wood, Jr.	Methuen
Walter Benjamin Worsman	Methuen

Mechanical Drawing—3 Years.

Remy Delphias Bertrand	Lowell
Real Emil Joseph Bolduc	Lowell
Clarence Marshall Dean	Forge Village
Arthur DeSpencer	Lawrence
Edwin Joseph Flagg	Lawrence
Frederick Bradford Martin	North Billerica
Michael James Shyne	North Andover

Alternating Current Electricity—2 Years.

Edward Francis Cassidy	Lowell
John Henry Graham	Lowell
Lucien Henry Haesebrouck	Lowell
Russell Charles Sheehan	Lowell
George Francis Spencer	Lowell
Ralph Emmons Tweed	Lowell

Direct Current Electricity—2 Years.

Peter Anderson	Andover
Remy Delphias Bertrand	Lowell
Real Emil Joseph Bolduc	Lowell
Alfred Walker Burgess	Lawrence
William Paul Jonis	Lowell
John Alexander Kasinskas	Lowell
Francis Xavier Lavallee	Lowell
Wilfred Charles Lynch	Lowell
Alexander Markewich	West Windham, N. H.
George James Megdanis	Lowell
Edward Francis Moran	Lowell
Arthur Loring Tisdale, Jr.	North Chelmsford

Machine Shop Practice—2 Years.

Francis Claudius Barry	Lowell
Raymond Irving Buchanan	Lowell
Raymond Joseph Demers	Lowell
John Stanley Fowler	Billerica
Edward Whitelaw Galaher	North Andover
Walter Lucien Gauthier	Lowell
John Edgar Greenwood	Lowell
Reginald Francis Horman	North Billerica
Mitchell Arthur Jason	Lowell
William Robertson Kiesling	Methuen
David Rae Liddle	North Andover
Armand Gerard Morin	Lowell
Edward Felix Padonevitch	Lowell
Joseph Michael Quinn	Maynard
William Henry Roy, Jr.	Lowell
Henry Emmanual Wazlaw	Lawrence

Mathematics—2 Years.

Thomas Edwin Banks	Lowell
Wilfred Bottomley	North Andover
Costas John Chiungos	Lowell
John Kain Clark	Lowell

Edward Robert Flood	Lowell
Edward Leo Garrity	Lowell
Philip Henry Goulding	Lowell
Harry Fjeld Halvorsen	Chelmsford
Stephen Charles Kapernaros	Lowell
William Russell Kiernan, Jr.	Lowell
Arthur Lawrence Lambert	Lowell
Paul Eugene Longval	Lowell
Malcolm McGowan	Lowell
Dorothy Marie Roark	Lowell
Harry Scarmeas	Lowell
Robert Harrison Stickney	Lowell
Michael Valentine Torla	Lawrence

Steam—1 Year.

John Bernard Gallagher	Lowell
Burton Allan Gould	Lowell
Paul Eugene Phelan	Nashua, N. H.
William Eric Wood	Lowell

Mechanics—1 Year.

Origene Joseph Allard	Lowell
Robert Alfred Fischer	Lawrence

Diesel Engines—1 Year

Joseph Thomas Ahern	Lawrence
Charles Lowe Aiken	Methuen
William Gail Alberghene	Lowell
Arthur Weston Alcott	Lowell
Lawson Wetmore Allaby	Lowell
Allan Angus	Lowell
Oscar Apkarian	Methuen
George Gordon Armstrong, Jr.	Littleton
Dwight Leslie Barnard	Lowell
Sidney Cyrus Barton	Lowell
Elmer Wayne Basley	Lowell
Harold Bennett	Methuen
John Edward Birchall	Lowell
Emile Blouin	Lawrence
Arthur Joseph Bourassa	Andover
Charles Parsons Brooks, Jr.	Melrose
Louis Gordon Buker	North Billerica
William Augustine Cannon, Jr.	Lawrence
Joseph Francis Carney	Lowell
Thomas Clark, Jr.	North Andover
Patrick Francis Comer	Lowell
David Albert Constantine	Lowell
Matthew Stanley Czubacki	Lawrence
Allan Dawson Davidson	Lowell
William Francis Dempsey	Lowell
Robert A. Dunstan	Billerica
George Pickering Edney	Lowell
Howard Wilmott Edwards	Lowell
Florand Joseph Gauthier	Lowell
Clement Alphonse Gendron	Lowell
Leighton Bernard Gendron	Lowell
John James Gillis	Lowell
Edward Chester Girard	North Andover
Donald Gordon	Lowell
Louis Joseph Greaves	Lowell
Michael John Grimolizzi	Lowell
John Joseph Hansbury	Lowell
Joseph Hines	Lawrence
Francis William Hogan	Lowell
William Franklin Huntley	Lowell
Ernest August Johnson	Nashua, N. H.
Walter Joseph Jurczak	Lawrence
Peter Kayros	Hudson, N. H.
Frederick Joseph Kelleher	Lawrence
Theodore Frank Koza	Lawrence
John Lawrence LaCarte	Methuen

Palmer Adolfus Lacoss	Lowell
John Joseph Leary	Lowell
Henry Wilbrod Lemire	Lowell
Harry Elwin Livermore	Tyngsboro
Ray William Livermore	Nashua, N. H.
Donald McKeown	North Billerica
Francis Homer McMorrow	Lowell
Edward Daniel Markham	Lowell
Henry Homer Martell	Lowell
Ernest Henry Martin	Lowell
Philip Butler Midgley	Lowell
Bernard Miller	Lowell
Charles William Miller	Lowell
William Blair Mochrie	Lowell
Andrew Reese Molloy	Lowell
Octave Abraham Montminy	Lowell
Arthur Joseph Moreau	Lowell
Armand Gerard Morin	Lowell
John Francis Moynihan	Lawrence
Joseph Richard Mozykowski	Lowell
Edward Felix Padonevitch	Lowell
Clifton Alden Perry	Dracut
Walter Cecil Perry	Medford Hillside
Henry Charles Pilawski	Lowell
Francis David Plunkett	Lowell
Martial Bernard Racette	Lowell
Henry George Robert	Lowell
Fred Haywood Robertson	Lowell
Joseph Harry Rushton	Methuen
Chester Edward Ruston	North Billerica
Joseph John Sagaties	Lowell
Gilbert Settle	Methuen
Edward Silva	Lowell
Andrew Jacob Slobodnik	Lawrence
Harold Arthur William Stacy	Lawrence
Ernest George Sullivan	Lowell
Douglas Ross Thomson	Lowell
Walter Edmond Traversy	Lowell
Earle Wesley True	North Billerica
James Phillip Tully	Lowell
Dore Earle Tyler	Lowell
James Michael Wallace	Lawrence
Edward Augustin Wood	Methuen
Rudolph Joseph Zygadlo	Lowell

Selling and Advertising—1 Year.

William Joseph Ahearn	Lowell
Nicholas Antifonario	Lowell
Mary Elizabeth Carney	Lowell
Arthur Compagnone	Lawrence
Frank Parker Conrad	Wilton, N. H.
Alfred Louis Dion	Lowell
Joseph Timothy Duggan	Lowell
Louis Costas Georgekakos	Lowell
Harold Charles Giffin	Lowell
Joseph Hanley	Bradford
Joseph James Higgins	Lowell
George Demeritt Kenniston	Lowell
John Nicholas Koumoutseas	Lowell
Raymond Anthony Laponsie	Wilton, N. H.
Raymond Gerard Larkin	Lowell
Joseph Henry Mellen	Lowell
Ralph Vincent Naples	Nashua, N. H.
Thomas Clifford Nelson	Lowell
Herbert Alexander Semple	Lawrence
Thomas Francis Sheehan	Lowell
Frank Anthony Siegler	Lawrence
Samuel Shattuck Spence	Nashua, N. H.
Malcolm Swain Stevens	Lowell
Edward William Tamulonis	Lowell
William Rogers Walsh	Lowell
William Benedict Welsh	North Billerica

SERIES 41, No. 2

November 1937

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Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1937

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Moody Street and Colonial Avenue

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AN INVESTIGATION OF THE POSSIBILITY OF QUANTITATIVE MEASUREMENT OF THE FASHION CYCLE

By Charles F. Edlund, S. B., Ed. M.,
Instructor in Sales Engineering

The following paper is a joint summary of three theses performed under the direction of the Textile Engineering Department by Arthur S. Freeman, J. Raymond Kaiser, and Sidney Boordetsky. These theses were a partial requirement for the degree of Bachelor of Textile Engineering.

THEORY

In the constant changes of fashion, there is a definite sequence of rise, culmination and decline. When the mass acceptance, i.e., sales, of any fashion is plotted against time, a curve results which may be called the fashion cycle. It measures quantitatively the rise and fall of the fashion in question. This fashion cycle was originally investigated by Paul H. Nystrom, Professor of Marketing at Columbia University, and reported in his book "Economics of Fashion." He assumed it to be a symmetrical bell-shaped curve. His evidence was based on an analysis of fashions illustrated in the back numbers of fashion magazines for a few items only, notably the length of women's skirts.

OBJECT

The present investigation was undertaken for the purpose of determining:

(A) If the curve of the fashion cycle as determined by Mr. Nystrom is correct.

(B) If some other curve is a better approximation.

(C) If there is a different curve for different items of fashion.

(D) If any definite fashion cycle exists at all, i.e., whether or not the variations in the rise and fall of successive fashions, when plotted against time, are so great as to preclude the possibility of any uniform conclusion as to the general shape of the curve.

Due to the limitation of time, these first three studies presented by Sales Option students consisted essentially of a preliminary investigation of the field to determine the proper approach to the subject and the existence and availability of records dealing with fashion sales.

PROCEDURE

Three possible approaches to the subject were investigated.

1. Investigation by a study of retail store records. By selecting a specific item or items it might be possible to measure quantitatively its rise and fall in consumer acceptance through the medium of retail sales records in a group of representative stores.

2. Investigation by a study of manufacturers' sales. By studying the sales records of manufacturers on specific items over a period of time, an accurate cycle might be obtained.

3. Nystrom's method of fashion magazines. Counting the frequency with which a given item appears from month to month, might give a measurement of the fashion's acceptance, rise and decline.

The possibility of actually counting, by means of statistical samples, the growth of a fashion amongst consumers was discarded as impractical for the resources of the school and students.

Mr. Freeman's investigation dealt largely with the third approach, that of fashion magazines. He also covered in a partial manner the possibility of retail store records as a source of fashion cycle measurement.

Mr. Kaiser's thesis covered retail records for women's wear items, both as to cut and to color, as a possible source of data.

Mr. Boordetsky investigated the records of men's wear, especially shirtings, kept by retailers, cutters-up, wholesalers, mills, selling agents and converters.

The method of investigation used was largely interviews with the proper executives in firms located in Lowell, Boston and New York. In addition, a number of firms were contacted by means of questionnaires.

Mr. Boordetsky contacted over 44 firms from mills to retailers in gathering data for his report. Mr. Kaiser conducted over 24 interviews with retailers in Lowell, Boston and New York, and Mr. Freeman conducted 3 in Boston. Mr. Freeman also investigated the back copies of Harper's Bazaar from 1930 to 1934 in an effort to measure by Nystrom's methods the fashion cycle in evening gowns. Over 627 evening gowns were classified as to period influence and the various period influences predominant in the gowns graphed as to monthly variations over the period in question.

CONCLUSIONS

1. An analysis of the fashion cycle by means of fashion magazines is inadequate for the purposes desired, because of the emphasis of the fashion magazines on the unusual style as well as many new styles which never become fashions, rather than on those styles selling in volume, i.e., fashions.

The difficulty of classification of styles illustrated in magazines make this source inadequate, in any case, except for the most basic and general trends, such as skirt lengths.

2. It is not possible to obtain a quantitative measurement of the fashion cycle through the medium of retail store records either in men's wear or women's wear. These records are kept from a merchandising rather than a fashion point of view.

In women's wear, retail records as to color, pattern and dress cut are grouped together in such broad basic classifications as to be worthless for a study of the desired type.

In men's wear with the exception of men's suitings, retail records were found to be of a similar nature.

3. A sufficient number of garment manufacturers in men's wear lines keep adequate records so that an analysis, at this level of distribution, of the fashion cycle may be possible. The records of garment manufacturers in women's wear have not yet been covered in the study.

4. The opinion of qualified people in all lines is divided as to the existence of a regualr fashion cycle. Those associated with retailing, in general, believe that fashion is purely haphazard in its operation. Those associated with manufacturing believe, in general, that fashion behaves in a statistical and logical manner capable of being quantitatively measured in line with the present study.

With the limited amount of time and money available, it is hoped to carry on this work still further until the existence of a regular fashion cycle is proved or disproved and, if it exists, its shape determined. The value of such a cycle to retailers and manufacturers alike, if it could be quantitatively determined, would of course be very great.

Southwick Hall

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6500. 3-'38. Order 3217.

CALENDAR

1937–1938

September 9–10, Thursday–Friday	Entrance Examinations
September 13–18, Monday–Saturday	Re-examinations
September 16, Thursday, 9.00 A.M.	Registration for Freshmen
September 20, Monday	Registration for upper-class students Classes begin for Freshmen
September 21, Tuesday	Classes begin for upper-class students
October 12, Tuesday	Columbus Day — Holiday
November 11, Thursday	Armistice Day — Holiday
November 23, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 29. Monday, 9.00 A.M.	Thanksgiving recess ends
December 17, Friday, 4.45 P.M.	Christmas recess begins
January 3, Monday, 9.00 A.M.	Christmas recess ends
January 17, Monday	First term examinations begin
January 28, Friday	End of first term
January 31, Monday	Second term begins
February 22, Tuesday	Washington's Birthday — Holiday
April 13, Wednesday, 4.45 P.M.	Spring recess begins
April 20, Thursday, 9.00 A.M.	Spring recess ends
May 23, Monday	Second-term examniations begin
May 30, Monday	Memorial Day — Holiday
June 7, Tuesday	Commencement
June 9–10, Thursday–Friday	Entrance Examinations

1938–1939

September 8–9, Thursday–Friday	Entrance Examinations
September 12–17, Monday–Saturday	Re-examinations
September 15, Thursday, 9.00 A.M.	Registration for Freshmen
September 19, Monday	Registration for upper-class students Classes begin for Freshmen
September 20, Tuesday	Classes begin for upper-class students
October 12, Wednesday	Columbus Day — Holiday
November 11, Friday	Armistice Day — Holiday
November 22, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 28, Monday, 9.00 A.M.	Thanksgiving recess ends
December 21, Wednesday, 4.45 P.M.	Christmas recess begins
January 4, Wednesday, 9.00 A.M.	Christmas recess ends
January 16, Monday	First term examinations begin
January 27, Friday	End of first term
January 30, Monday	Second term begins
February 22, Wednesday	Washington's Birthday — Holiday
March 31, Friday, 4.45 P.M.	Spring recess begins
April 10, Monday, 9.00 A.M.	Spring recess ends
April 19, Wednesday	Patriots' Day — Holiday
May 22, Monday	Second term examinations begin
May 30, Tuesday	Memorial Day — Holiday
June 6, Tuesday	Commencement
June 8–9, Thursday–Friday	Entrance Examinations

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Clerk

HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The day classes have been organized for those who can devote their entire time for three or more years to the instruction requisite in preparing to enter the textile industries. It has been found necessary to require of all such students educational qualifications equivalent to those given by a regular four-year course of a high school or academy of good standing.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Colonial Avenue Building was erected in the summer of 1910 from plans prepared by the Engineering Department, which also had charge of the work of construction. The building of one story in height completed the fourth side of the quadrangle and in outward appearance corresponds to the architectural features of the other school buildings. At the present time the construction of three additional stories is in progress and at its dedication will be called The Louis Pasteur Hall.

In addition to the class rooms and laboratories of the Wool Yarns, Cotton Finishing, and Chemistry and Dyeing Departments now in this building it will provide three floors to be used by the Chemistry and Dyeing Department.

The buildings are of modern mill construction adapted to educational uses and contain approximately 181,294 square feet.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for baseball, football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Bcard or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry, beginning September, 1940	1
	12

Elective Subjects

	Points
Chemistry	1
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

It is highly desirable that students entering before September, 1940, present a year of chemistry with laboratory.

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of thirteen points is required.

Required Subjects

	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry, beginning September, 1940	1
	10

Elective Subjects

Four may be selected from the list under Degree Courses.

It is highly desirable that students entering before September, 1940, present a year of chemistry with laboratory.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 9, 1938; Thursday, September 8, 1938; Thursday, June 8, 1939:—
- Algebra, 9 A.M. to 11 A.M.
- History, 11 A.M. to 1 P.M.
- English, 2 P.M. to 4 P.M.

Friday, June 10, 1938; Friday, September 9, 1938; Friday, June 9, 1939:—
- Plane Geometry, 9 A.M. to 11 A.M.
- German or French, 11 A.M. to 1 P.M.
- Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

Chemistry.—Applicants must show evidence of their familiarity with the rudiments of chemistry. Any course given in a secondary school organized to

present instruction by means of textbook or lecture, together with correlated laboratory work, will be considered as covering the requirements. The applicant's notebook with his original notes, including description of experiment, apparatus used, reactions, observations and deductions, must be accompanied by his instructor's certificate.

Importance will be placed upon manipulation and deductions as well as the general appearance and neatness of the notebook.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Although all classes are open to women, the courses which have appealed especially to their tastes have been textile designing and decorative art. Some have pursued courses in chemistry, and have added to their work in design some instruction in power weaving and finishing. In general these special courses have been followed for three years and in some cases have led the students to positions either in the mill office or in some commercial lines that have been desirable and have offered congenial work.

Within the last few years the possibilities for women in certain branches of textile chemistry and textile manufacturing have become recognized and it is believed that in the future the positions open to them will become more and more numerous.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students shall be the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course shall be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential

subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 15, at 9.00 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 9.00 A.M. to 12.50 P.M., and from 1.55 to 4.45 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

CHANGE IN TUITION RATES

The following rates will apply for new students entering the Institute for the school year beginning September 1938 unless changed by vote of the Board of Trustees:

Residents of Massachusetts	$150 per year
Residents of United States outside of Massachusetts	$250 per year
Citizens of Foreign Countries	$400 per year

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee for all courses is $200 per year. The fee for students from foreign countries is $300 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a

statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—All students not taking chemistry are required to make a deposit of $10 each year to cover general breakage, the unexpended balance to be returned at the end of the year to students not otherwise in arrears.

First year students taking Chemistry are required to make a deposit of $25. Second, third and fourth year chemistry students are required to make a deposit of $25 each term. The unexpended balance will be returned at the end of the year to students not otherwise in arrears.

All deposits must be made before students can be admitted to laboratory work.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers, sufficiently capacious to contain clothing, books and tools, are provided for the use of the students.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	200
Tuition (foreigners)	300
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee (This applies to students who do not take chemistry or machine shop.)	10
Books and supplies (Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	50

PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship throughout the course.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Section of the American Society of Dyers and Colorists hold meetings at which papers are delivered or speakers come from outside the school organization.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store.—A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purchasing from the Book Store and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of tbe association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1937–38

E. Dean Walen, '14, *President*
Russell T. Fisher, '14, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*
A. Edwin Wells, '20, *Assistant Secretary*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Executive Committee

Roy H. Bradford, '06
Alexander Campbell, '23
James F. Dewey, '04
Parker F. Dunlap, '34
Russell T. Fisher, '14
Olin D. Gay, '08
Thomas Joy, '26
Harry W. Martin, '11
Brackett Parsons, '20
Richard W. Rawlinson, '31
Everett B. Rich, '11
Henry S. Sawyer, '32
Dean W. Symmes, '22
J. Milton Washburn, Jr., '21

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term
(Common to all Courses)

	Hours of Exercise
Elementary Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Chemistry C–10	75	75
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–11 or C–11a	150	45
Stoichiometry C–12	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C-20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

Third Year. First Term

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	135
Cotton Yarn Manufacture F–30	165	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

Third Year. Second Term

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	210	Thesis F–34.	
Knitting F–31	120		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence. Instruction in the production and manipulation of re-worked wool is also included.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

Second Year. Second Term

Fiber Preparation G–20–21	270	Textile Chemistry and Dyeing Lect. C-20.	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	60
Power Weaving D–24	120		

Third Year. First Term

Electricity B–31a	30	Textile Testing G–31	30
Knitting F–31	105	Woolen and Worsted Finishing H–30	75
Mill Engineering B–34a	30	Worsted Yarn Manufacture G–30	165
Power Weaving D–32	90		

Third Year. Second Term

Power Weaving D–32	150	Worsted Yarn Manufacture G–30	300
Woolen and Worsted Finishing H–30	75	Thesis.	

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C-10	75	Physical Education	30
English E-10	45	Qualitative Analysis C-11a	45
Machine Drawing B-13	135	Textile Design and Cloth Analysis D-10	75
Mathematics B-10	60		
Mechanism B-12	60		

Second Year. First Term

Cotton Yarn Manufacture F-20a	90	Steam Engineering B-24	30
Color and Dynamic Symmetry D-33	30	Textile Chemistry and Dyeing Lect. C-20	30
Physics B-23a	45	Textile Design and Cloth Construction D-20, 21	210
Power Weaving D-24	90		

Second Year. Second Term

Cotton Yarn Manufacture F-20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G-20-21	90	Textile Design and Cloth Construction D-20, 21	135
Jacquard Design D-23	45		
Physics B-23a	45		
Power Weaving D-24	120		

Third Year. First Term

Cotton Finishing H-31	75	Textile Testing G-31	30
Cotton Yarn Manufacture F-30a	60	Woolen and Worsted Finishing H-30	75
Power Weaving D-32	60	Worsted Yarn Manufacture G-30	90
Textile Design and Cloth Construction D-30	105		

Third Year. Second Term

Cotton Finishing H-31	75	Woolen and Worsted Finishing H-30	75
Cotton Yarn Manufacture F-30a	60	Worsted Yarn Manufacture G-30	60
Jacquard Design D-31	75	Thesis.	
Power Weaving D-32	105		
Textile Design and Cloth Construction D-30	75		

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultra-microscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several elective subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45
Adv. Organic Chemistry C–22	30
English E–20	30
Mathematics B–20a	60
Physics B–23	65
Power Weaving D–23	15
Quantitative Analysis C–23	130
Stoichiometry C–24	15
Textile Chemistry and Dyeing Lab. C–21	90
Textile Chemistry and Dyeing Lect. C–20	45

Second Year. Second Term

Advanced German E–21	45
Adv. Organic Chemistry C–22	30
English E–20	30
Physics B–23	65
Quantitative Analysis C–23	150
Stoichiometry C–24	15
Textile Chemistry and Dyeing Lab. C–21	145
Textile Chemistry and Dyeing Lect. C–20	45

Third Year. First Term

Adv. Organic Chemistry Lect. C–34	15
Adv. Textile Chemistry and Dyeing Lab. C–32	135
Adv. Textile Chemistry and Dyeing Lect. C–32	30
Economics E–30	45
Physical Chemistry C–33	45
Quantitative Analysis C–30	150
Technical German C–35	30
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	90
Adv. Textile Chemistry and Dyeing Lect. C–32	15
Economics E–30	45
Industrial Chemistry C–31	30
Organic Laboratory C–36	90
Physical Chemistry C–33	45
Quantitative Analysis C–30	105
Technical German C–35	30
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	75
Adv. Textile Chemistry and Dyeing Lect. C–44	30
Chemical Textile Testing C–43	45
Colloid Chemistry C–50	30
Industrial Chemistry C-42	30
Microscopy and Photomicroscopy C–45	60
Electives or Thesis C–52	90
Organic Laboratory C–41	75
Quantitative Analysis C–46	15
Report Writing C–47	15
Technical German C–40	30
Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30
Adv. Textile Chemistry and Dyeing Lab. C–44	120
Adv. Textile Chemistry and Dyeing Lect. C–44	15
Chemical Textile Testing C–43	45
Electives or Thesis C–52	90
Organic Laboratory C–41	105
Rayon Manufacturing C–51	30
Seminar in Business English E–40	15
Technical German C–40	30
Technology of Wool Manufacture Fibers G-40	15
Textile Literature C–48	30

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The course is planned so as to provide a foundation in those subjects which are essential to the training of an engineer, coupled with a thorough understanding of textile processes and materials. Such subjects as mathematics, physics, chemistry, drawing, mechanics and mechanism, provide for the first objective. The second is secured by a study of cotton, woolen and worsted yarn manufacturing, textile designing, weaving, knitting, dyeing, and finishing. Instruction is by means of lectures, recitations and laboratory work.

A large proportion of the student's time is spent in well equipped textile departments where he is familiarized with the machinery and processes used in the conversion of cotton and wool fibers into yarns and finished fabrics. The subjects of textile testing and microscopy acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering. Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice. Mill engineering familiarizes the student with factory design, construction, heating, lighting, humidification, fire protection, and the arrangement of machinery and buildings for most efficient production and economical power distribution.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

The Cotton and Wool Options of the Textile Engineering course have been provided for those students who may desire the breadth of technical training which this course offers but who wish to specialize in either cotton or wool manufacturing. In these optional courses the student's entire time is devoted to the study of that particular fiber which he elects. A demand from the distributing and marketing divisions of the textile industry for properly trained men has lead to the establishment of the Sales Option of the Textile Engineering course. This is patterned after the General Course but with more time devoted to such subjects as selling, advertising, marketing, foreign trade and the like. There have also been requests for a four-year degree course in which the design of textile materials should receive the greater emphasis. For this purpose the Design Option of the Textile Engineering course is offered, which, while majoring in textile design, includes other subjects that make a broader course than the one of shorter duration.

In the General, Design and Sales Options some recognition is given to those who may wish to lay more emphasis on knit fabrics. This is done by the substitution of knitting laboratory time for a portion of that assigned to weaving laboratory and is dependent on the possibility of arranging for such special cases.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	75
Fiber Preparation G–20, 21	120
Machine Drawing B–21	45
Machine Shop B–26	75
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–20	30
Textile Design and Cloth Construction D–22	45

Second Year. Second Term

Applied Mechanics B–25	45
Cotton Yarn Manufacture F–20a	75
Electives F–25	
Fiber Preparation G–20, 21	90
Machine Drawing B–21	75
Mathematics B–20	60
Physics B–23	75
Power Weaving D–24	75
Textile Chemistry and Dyeing Lect. C-20	30

Third Year. First Term

Applied Mechanics B–30	45
Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Electives F–35	
Electrical Engineering B–31	75
Heat Engineering B–32	75
Power Weaving D–32	60
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Electrical Engineering B–31	75
Heat Engineering B–33	90
Mill Engineering B–34	90
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Accounting B–40	90
Cotton Organization F–32	90
Electrical Engineering B–44	68
Mill Engineering B–45	67
Textile Marketing B–42	30
Textile Microscopy B–41	45
Textile Testing B–43	60
Thesis	75

Fourth Year. Second Term

Business Administration B–46	90
Cotton Finishing H–31	105
Electives B–48 or F–45	
Electrical Engineering B–44	75
Knitting F–31a	30
Mill Engineering B–45	75
Mill Illumination B–47	45
Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	180	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	90	Textile Design and Cloth Construction D–20	90
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Applied Mechanics B–25	45	Power Weaving D–24	60
Cotton Yarn Manufacture F–20a	135	Textile Chemistry and Dyeing Lect. C-20.	30
Machine Drawing B-21	45	Textile Design and Cloth Construction D–20	75
Mathematics B–20	60		
Physics B–23	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	180	Machine Shop B–26	45
Economics E–30	45	Power Weaving D–32	60
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	180	Heat Engineering B–33	90
Economics E–30	45	Mill Engineering B–34	90
Electrical Engineering B–31	75	Power Weaving D–32	45

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	105	Textile Microscopy B–41	45
Electrical Engineering B–44	68	Textile Testing B–43	45
Mill Engineering B–45	30	Thesis	97

Fourth Year. Second Term

Business Administration B-46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Fiber Preparation G–20, 21	225	Mathematics B–20	60
Machine Drawing B-21	90	Physics B–23	75
Machine Shop B–26	45	Textile Chemistry and Dyeing Lecture C–20	30

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B-21	45	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

Third Year. Second Term

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Electrical Engineering B–44	68	Textile Microscopy B–41	45
Mill Engineering B–45	30	Textile Testing B–43	60
Textile Design and Cloth Construction D–21	75	Thesis	127

Fourth Year. Second Term

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F-31	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Power Weaving D–24	105
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60	Textile Design and Cloth Construction D–20, 21	105
Physics B–23	75		

Third Year. First Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	120		

Third Year. Second Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	75
Cotton Yarn Manufacture F–30a	75	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Textile Design and Cloth Construction D-41	90	Textile Testing B-43	60
Textile Marketing B–42	30	Thesis	90

Fourth Year. Second Term

Business Administration B–46	90	Textile Design and Cloth Construction D-41	90
Cotton Finishing H–31	105	Thesis	135
Jacquard Design and Weaving D-40	105		

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	75		
Principles of Marketing B–35	45		

Third Year. Second Term

Color and Dynamic Symmetry D–33	30	Statistics	45
Cotton Yarn Manufacture F–30a	75	Textile Design and Cloth Construction D–30	75
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Marketing Methods B–36	60	Woolen and Worsted Finishing H–30	75
Power Weaving D-32	30		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Principles of Selling and Advertising B–49	105	Textile Styling B–50	30
Selling Policies B–52	45	Textile Testing B–43	60
Textile Design and Cloth Construction D-41	60	Thesis	90

Fourth Year. Second Term

Business Administration B–46	90	Jacquard Design and Weaving D–40	30
Cotton Finishing H–31	105	Knitting F–31	75
Foreign Trade and Economic Geography B–51	45	Selling Policies B–52	45
		Thesis	165

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.[

Mechanical Drawing—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals,

summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B-20a. Preparation: B-10. This subject is a continuation of the work of the first-year subject B-10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B-21. Preparation: B-10, B-12, B-13. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B-23. Preparation: B-10 and B-11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B-23a. Preparation: B-10 and B-11. This subject consists of the same topics as B-23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B-24. Preparation: B-12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B-25. Preparation: B-11, B-20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B-26. Preparation: B-11 and B-12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as

possible to commercial machine-shop practice on textile machinery. The list of tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B-30. Preparation: B-25. This is a continuation of Applied Mechanics B-25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B-31. Preparation: B-23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B-31a. Preparation: B-23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B-32. Preparation: B-12, B-20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B-33. Preparation: B-32. This course is a continuation of B-32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates. with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B–34. Preparation: B–21, B–25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B–34a. Preparation: B–21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B–34. [Courses I, II.]

Principles of Marketing—B–35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B–36. Preparation: B–35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Accounting—B–40. Preparation: B–10 and E–30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Textile Microscopy—B–41. Preparation: B–23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with acccompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B-47. Preparation: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B–48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B–49. Preparation: B–36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B–50. Preparation: D–30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B–51. Preparation: E–30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B–52. Preparation: B–49. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B–53. Preparations: B–20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Chemistry (Inorganic and Organic Chemistry)—C–10. Preparation: Admission Requirements. Instruction in Inorganic Chemistry extends through the first year, and includes lectures, recitations and laboratory work. The subject of Organic Chemistry is covered by lectures during the second term.

Elementary Inorganic Chemistry

During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C–11.

Elementary Organic Chemistry

This course includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C-20. [All courses.]

Qualitative Analysis—C-11. Preparation: C-10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C-10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as testing mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C-11a. Preparation: C-10, taken simultaneously. This course is similar to C-11, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C-12. Preparation: C-10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C-20. Preparation: C-10, B-12, B-13a. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents,

developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; réduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C-21. Preparation: C-20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

Bleaching processes applicable to various animal and vegetable fibres are studied.

Work in color matching is also carried out on a laboratory scale. A fairly extensive study of the fastness properties of representative dyes of each class is taken up as well as their suitability for various classes of work.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Advanced Organic Chemistry—C-22. Preparation: C-10. In this course, which consists of lectures and recitations, the principles of organic substitution and synthesis are thoroughly discussed and as many illustrations are used as time

will permit, particularly such as are applied in the arts. The aliphatic series of hydrocarbons and their derivatives are studied for about twenty weeks, the remainder of the time being devoted to the benzine series. The aim of the course is to lay a broad foundation for the study of the chemistry of the artificial dyestuffs. Students are required to work out problems in the synthesis of various compounds, in order to become familiarized with equation writing. [Course IV.]

Quantitative Analysis—C–23. Preparation: C–11. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Talbot's "Quantitative Chemical Analysis" 1937 Edition is used as a text. [Course IV.]

Stoichiometry—C–24. Preparation: B–10, C–10, C–12. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C–30. Preparation: C–23. The fundamental principles acquired in Course C–23 are applied in this course in the examination of materials used in the textile mill the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. Griffin's" Methods of Technical Analysis" is used as a text. [Course IV.]

Industrial Chemistry (Lecture)—C–31. Preparation: C–22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's " Industrial Chemistry," Third Edition. Particular attention is paid to those subjects which are of special interest to the textile chemist, as oils, soaps, gas and coal-tar industry, building materials, and the manufacture on a large scale of important chemical compounds, such as the common acids and alkalies, bleaching powders, various mordants, etc. The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–32. Preparation: C–20, C–21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–12. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Advanced Organic Chemistry—C–34. Preparation: C–22. This is a continuation of Advanced Organic Chemistry C–22. [Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory—C–36. Preparation: C–20, C–22, C–23. This course, while including practice in the usual methods of organic analysis, and giving excellent training in the principles and manipulations of general organic synthesis, is especially devoted to the synthetic dyestuffs. The student not only prepares many of the representative dyestuffs, but, what is far more important, he carries out all the operations, beginning with coal tar itself. Thus, instead of merely coupling two or more of the foreign imported intermediate products to make a dyestuff, he starts with the basic substances obtained from the coal tar and makes his own intermediate products. As far as is possible the student will be made acquainted with the problems which might arise in a dyestuff factory, and an excellent opportunity is presented for original work. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory—C–41. Preparation: C–34. This is a continuation of Organic Chemistry Laboratory C–34. [Course IV.]

Industrial Chemistry—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31. [Course IV.]

Chemical Textile Testing—C–43. Preparation: C–21, C–32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Statistical methods, relative humidity, regain, staple, hair weight, fiber resiliency, counts and denier, twist, evenness, cloth count, weight, crimp, thickness, porosity, permeability, waterproofness, wetting out, absorbency, shrinkage, thermal insulating value, handle or draping quality, wear or abrasion, strength and stretch.

Chemical Testing.—Ash, ash alkalinity, weighting, copper and manganese, acids and bases, sizing, oils, waxes, greases, soaps, fiber blends, baryta absorption, solubility in caustic, Methylene Blue absorption, copper number, fluidity in cuprammonia, nitrogen by Kjeldahl, sulfur by Benedict-Davis, ammonia nitrogen, Pauly test, solubility of wool in sodium hydroxide, viscosity of silk.

Optical Testing.—Colorimeter, tintometer, pH apparatus, refractometer, spectroscope, spectrophotometer, ultra-violet, infra-red, luster. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–44. Preparation: C–32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C–45. Preparation: B–23, C–20, C–22. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon.

The lectures also include the subject of photomicroscopy. The laboratory course may be selected by the student as an optional course. [Course IV.]

Quantitative Analysis—C–46. Preparation: C–30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C–47. Preparation: B–20a, E–20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

Textile Literature—C-48. Preparation: C-47. This object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

Advanced General Chemistry—C-49. Preparation: C-10, C-11, C-24, C-34, C-42, C-46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Colloid Chemistry—C-50. Preparation: C-33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Adsorption, surface tension and wetting-out, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of irreversible emulsoids, protective colloids and detergents, gels, amorphous solids, use of X-rays, properties of proteins.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, paper, cellulose esters and lacquers, rayons, silk, wool, silk weighting, mordanting, dyeing, felting of wool. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C-51. Preparation: C-32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Elective Subjects or Thesis during fourth year—C-52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take elective work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931-32 several electives were introduced, each elective period being 45 hours per term and four of these being required during the year.

Thesis. If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more elective periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or elective subjects, will be required for graduation.

Photography. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

Photomicroscopy Laboratory. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both fibers and fabrics. Students taking this elective should have had Photography or the equivalent in experience.

Advanced Microscopy. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

Colloid Chemistry Laboratory. Experiments illustrating and amplifying the lecture course are performed. These may be on adsorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is suually in the form of directed research.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conducttivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D-10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–20. For Cotton Goods—Preparation: D–10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D–21. For Woolen and Worsted Goods—Preparation: D–10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D–22. Preparation: D–10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D–23. Preparation: D–10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D–24. Preparation: D–10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, the cutting and lacing of cards, spooling and quilling and the machinery for the same. A study is made of warpers and sizing machines, both for cotton and woolen. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, shuttle changing looms, dobby looms, single and double acting dobbies, handkerchief motions, leno weaving, center selvedge motion, filling changing looms, oscillating reeds, lappet motions, various shaker motions, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, tying up Jacquard harness. [Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–30. Preparation: D–20 or D–21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

Jacquard Design—D–31. This is a continuation of Jacquard Design D–23. [Course III.]

Power Weaving—D–32. Preparation: D–20, D–21, or D–23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, various shaker motions, lappet loom weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen and worsted and cotton; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. [Courses I, II, III, VI.]

Color and Dynamic Symmetry—D–33. Color.—A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question.

Dynamic Symmetry.—A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. [Courses III and VI, Options D, S.]

Jacquard Design and Weaving—D–40. Preparation: D–23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D–41. Preparation: D–10, D–20, D–21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art for Special Students. This course is planned to give a student a working knowledge and appreciation of design. The first and second years are devoted to a general study of design, color, perspective, lettering and rendering. Drawings are made in the historic styles for all materials,—wood, gold, silver, copper, brass, leather, fabrics, wall papers and glass.

In the third year students should specialize and devote their attention to the material in which they expect to work.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E–10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric

and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E–11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E–20. Preparation: E–10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E–21. Preparation: E–11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E–30. Preparation: E–10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

Seminar in Business English—E–40. Preparation: E–10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON DEPARTMENT — F

Cotton Carding—F–20. Preparation: B–10, B–12, B–13. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin, Nasmith, and Saco-Lowell combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine, jack, and long draft roving are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F-20a. Preparation: B-10, B-12, B-13. This course is similar to Course F-20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F-25. Preparation: B-12, D-10. This course covers the same lectures and laboratory work as F-31. [Course VI, Option G.]

Cotton Spinning—F-30. Preparation: F-20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of regular and long draft ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions. The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F-30a. Preparation: F-20a. This course is similar to Course F-30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F-31. Preparation: B-12, D-10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II, VI, Options C, W, S.]

Knitting—F-31a. Preparation: B-12, D-10. This course embraces the same lectures as Course F-31 but does not include any laboratory work. [Course VI, Option G.]

Cotton Organization—F-32. Preparation: F-20 or F-20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Knitting—F-35. Preparation: F-25. This course, given to students specializing in knitting, includes a more detailed study of hosiery and underwear manufacture with some time devoted to the manufacture of warp knit fabrics. [Course VI, Option G.]

Thesis—F-34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

Knitting—F-45. Preparation: F-35. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL DEPARTMENT—G

Fiber Preparation—G-20. Preparation: B-10, B-12, B-13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or which are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in scouring; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Carbonizing.—The various methods of stock carbonizing are explained in detail in the lecture course. Actual carbonizing of noil, burr waste, and defective wool is carried out by the sulphuric acid method on commercial size machines in the laboratory.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G-21. Preparation: B-10, B-12, B-13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.— Mixing and shading of colors and qualities of wool are studied and practiced. The details of Burr Pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W, D, S.]

Worsted Yarn Manufacture—G-30. Preparation: G-20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced

on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G–31. Preparation: B–23, F–30 or G–30, D–24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G–40. Preparation: C–21, C–32, D–10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H–30. Preparation: B–12, C–10, D–10, D–24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the

method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure. moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process: the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $330,850.00, is most varied for textile educational purposes, and is being constantly augmented. The builders

of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of a 40-inch Saco-Lowell three beater single process picker.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B–5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat-lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division. — The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company.

Installed by C. G. Sargent's Sons Corporation: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc.: One 120-spindle cam mule complete.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son: One card grinding stand with two traverse grinders complete.

Shoddy or Reworked Fiber Division. — Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division. — Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops; two worsted combs with baller punch, one made by Crompton & Knowles, and the second made by James Smith & Sons: two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works. In addition to this the Saco-Lowell Shops have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory as well as in the testing laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system of six humidifiers and four Comin's High Duty heads, under automatic control.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery was made by the Société Alsacienne de Constructions Mechaniques, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device, gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam -driven air compressor.

Textile Testing Division. — Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company; single yarn and fabric strength-testing machines made by G. R. Smith & Company; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company, a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, one General Electric mercury vapor lamp with stand for top inspection, one Edgerton stroboscope.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company. The Whitin Machine Company has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8 spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company.

The Weaving Department contains four looms supplied by the Draper Corporation, which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company. The Hopedale Manufacturing Company installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one

Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift, double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table. The Balance Room has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company. The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé fractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with fifty-six steam heated dyeing baths and individual benches, reels and balances. There is also an ageing chamber and a Philadelphia Drying Machinery Company's Hurricane Dryer besides a large collection of dyestuffs.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, and a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine; a set of drying cans; a chain dyeing machine; a raw stock drying table; a padding mangle; a hydro-extractor; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company. The Franklin Process Company has furnished a 25-pound bronze dyeing machine.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company; a sample fulling mill, a kicker mill, furnished by James Hunter & Company; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co.; a tentering and drying machine furnished by John Heathcote; a single crabbing machine, H. W. Butterworth & Son; a 72-inch woolen napper donated by Davis & Furber; a 32-inch basket hydro-extractor, W. H. Tolhurst; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company; a steam press for underwear, United States Hoffman Company; a sewing machine, Birch Brothers; a trimming and overseaming machine, The Merrow Machine Company.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber (the ball bearings were donated by the Fafnir Bearing Company); a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company; a trimming and overseaming machine, The Merrow Machine Company; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alden absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-kilowatt rotary transformer and three Westinghouse stationary transformers. The other section is the instrument laboratory and is for the purpose of giving instruction in the measurement of current, voltage, resistance, and in the calibration of instruments. It is supplied with standard alternating and direct current measuring instruments of a wide range of sizes and capacities. A 160 ampere hour storage battery offers a source of constant voltage. A standard Leeds & Northrup photometer with Lummer-Brodhun screen and Macbeth illuminometer provide means of illumination measurements.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10 foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company; an engine lathe, 18-inch swing, 6 foot bed from Champion Tool Works; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son; one 14-inch single sensitive drill, from the Stanley Manufacturing Company; one No. 1 Universal grinder, from Landis Tool Company; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount; an American twist drill grinder, from the Heald Machine Company; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company; one 30-inch grindstone and frame, from the Athol Machine Company; a single spindle centering machine, from D. E. Whiton Machine Company; one 15-inch shaper, from Potter & Johnson; one power hacksaw, from the Fairbanks Company; one cold saw, from John T. Burr & Son; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

GRADUATES WITH TITLES OF THESES

June 8, 1937

Bachelor of Textile Chemistry

As thesis is now optional in the Department of Chemistry and Textile Coloring, no thesis subjects have been listed.

Gustave Warren Hakanson	Winchester, Mass.
Lee Gale Johnston	Haverhill, Mass.
Charles Ernest Lincoln	Mattapan, Mass.
Robert Keith Lyle	Lowell, Mass.
Charles Megas	Lowell, Mass.
Basil Andrew Natsios	Lowell, Mass.
Francis Xavier Nerney	Dracut, Mass.
Paul William Regan	Lowell, Mass.
James Peter Spanos	Lowell, Mass.
Socrates Vasilios Vaniotis	Lowell, Mass.
Herbert William Wilkinson, Jr.	Thompson, Conn.

Master of Science in Textile Engineering

Marian Brownson Calder, Dallas, Texas. B.S. 1934 Texas State College for Women. "A comparison of two methods of measuring the thermal conductivity of fabrics."

Harold Mills Manderbach, Lowell, Mass. B.A. 1924 University of Michigan. "An investigation of the relation between the number of tests and the mean breaking strength of a two-ply worsted yarn."

Bachelor of Textile Engineering

Louis Loss Bassett, Lowell, Mass. "A study of the use of arbitration in commercial disputes in the textile industry."

Sidney Morris Boordetsky, Cambridge, Mass. "An investigation of the possibility of quantitative measurements of the fashion cycle in men's shirtings."

William James Daly, Andover, Mass. "The construction and calibration of an improved Walen-Parsons evenness tester."

Thomas Nathan Fisher, Lowell, Mass. "A comparison of two methods of measuring the air permeability of fabrics."

Harold Ernest Reed, Nashua, N. H. "Conditioning boxes."

Lucy Wiley Robbins, Lowell, Mass. "A study of color measurements of silk fabrics."

Harvey Chih Sung, Tientsin, China. "A determination of the relation between the strength and twist of two-ply worsted yarns."

Diploma in Wool Manufacture

Leon Stearns Gay, Jr., Lowell, Mass. "The manufacture of a woolen flannel suiting from scoured and frosted wools."

Prizes awarded in June, 1937

The Medal of the National Association of Cotton Manufacturers awarded to the student taking course in Cotton who maintains the highest average in scholarship throughout this course. To *Louis Loss Bassett.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *Gustave Warren Hakanson.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Herbert Charles Olsen.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *William Benjamin Prescott.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Arthur Sabin Davis.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *Arthur William Lanner.*

REGISTER OF DAY STUDENTS

Graduate Students

Home Address	*Lowell Address*
Acar, Ibrahim Zeki, VI, Istanbul, Turkey B. Sc. Tech., University of Manchester, 1936	52 Mt. Washington Street
Bethel, Ion Maywood, VI, Philadelphia, Pa. B.S., Texas Agricultural & Mechanical College, 1925	250 Nesmith Street
Lizak, Boleck Louis, IV, Chicago, Ill. B.S., Lewis Institute, 1937	43 Plymouth Street
Parechanian, James Humphrey, IV, Lowell, Mass. B.T.C., Lowell Textile Institute, 1935	1 Summer Court
Prien, Walter Ferdinand, VI, Milwaukee, Wis. B.S., U. S. Naval Academy, 1930	235 Princeton Boulevard
Robbins, Lucy Wiley, VI, Lowell, Mass. B.T.E., Lowell Textile Institute, 1937	102 South Loring Street
Steadman, Frank M., VI, Indianapolis, Ind. B.S., U. S. Military Academy, 1929	22 Fairgrove Avenue

Undergraduate Students
Candidates for Degree

Class of 1938

Broadhurst, Russell Denton, IV, Middletown, Conn.	50 Standish Street
Buckley, Herman Timothy, IV, East Chelmsford, Mass.	———
Carroll, Hugh Francis, IV, Medford, Mass.	———
Fleming, John Harvey, VI, Sanford, Me.	Omicron Pi House
Fox, Kenneth Russell, VI, Lowell, Mass.	359 Beacon Street
Freedman, David, VI, Boston, Mass.	1280 Middlesex Street
Fyfe, Robert Clark, VI, Lowell, Mass.	148 Riverside Street
Garcia, Lorenzo Montero, VI, Mexico D. F., Mexico	337 Beacon Street
Getchell, Nelson Fletcher, IV, Lowell, Mass.	75 Pine Street
Grossman, Clinton, IV, Providence, R. I.	1280 Middlesex Street
Hardy, Thomas Wadsworth, IV, Lowell, Mass.	30 Chauncey Avenue
Harpoot, Burgess Charles, VI, Lowell, Mass.	185 Liberty Street
Howard, Winfield Hersey, IV, North Chelmsford, Mass.	———
Kahn, Seymour James, IV, Lowell, Mass.	116 Princeton Boulevard
Kaplan, Samuel Gilbert, IV, Lowell, Mass.	472 Wilder Street
Kelakos, Charles George, VI, Lowell, Mass.	6 Rockdale Avenue
Kelly, Warren Thomas, VI, Lowell, Mass.	41 E Street
Kennedy, Robert Miller, VI, Dunstable, Mass.	———
Klosowicz, Edward Joseph, VI, Lowell, Mass.	40 Read Street
Knight, Richard Greene Howland, Jr., VI, Fall River, Mass.	50 Standish Street
Lemieux, Robert Alphonse, IV, Lowell, Mass.	56 Third Avenue
Littlefield, Carl Richard, VI, Lowell, Mass.	69 Warwick Street
Lutz, Helmuth Erich, IV, Lowell, Mass.	7 Houghton Street
McMahon, Martin Edward, IV, Lowell, Mass.	43 London Street
Mahoney, Joseph Healey, IV, Andover, Mass.	———
Olsen, Earl Edward, VI, Reading, Mass.	———
Paige, Walter Hale, Jr., VI, New Bedford, Mass.	Omicron Pi House
Ploubides, John Peter, IV, Lowell, Mass.	59 Varney Street
Qualey, Francis Joseph, IV, Lowell, Mass.	126 London Street
Reddish, Charles Warren, IV, Cincinnati, Ohio	548 Fletcher Street
Shapiro, Sidney, VI, Lowell, Mass.	134 Bellevue Street

Home Address	*Lowell Address*
Sheehan, Leo James, IV, Dracut, Mass.	————
Sood, George David, IV, Woonsocket, R. I.	793 Merrimack Street
Wagner, George Frederic, Jr., VI, Lowell, Mass.	42 Marlboro Street
Wright, George Ward, Jr., IV, Newtonville, Mass.	Omicron Pi House

Class of 1939

Baker, Phyllis Jeanne, VI, Concord, Mass.	Dalton Road, Chelmsford
Banta, John Garret, VI, Grantwood, N. J.	Phi Psi House
Beauregard, Albert Joseph, VI, Lowell, Mass.	258 Varnum Avenue
Bone, Arthur P. Stuart, VI, Lowell, Mass.	Phi Psi House
Brantman, Jackson Agmor, VI, New York, N. Y.	Phi Psi House
Colby, Vernon Warren, IV, Haverhill, Mass.	————
Comins, Richard Coolidge, VI, Ballardvale, Mass.	————
Cunningham, Harold Russell, IV, Lowell, Mass.	7 Waite Street
Derzawetz, Joseph, VI, Boston, Mass.	————
Dick, Henry Kendal, Jr., VI, Bloomfield, N. J.	75 Fourth Avenue
Dori, Anita Marie, VI, Chester, Mass.	137 Riverside Street
Fox, Theodore Webster, VI, Lowell, Mass.	359 Beacon Street
Gianaris, George Demetrios, VI, Lowell, Mass.	678 Lakeview Avenue
Goodwin, John Alden, VI, Lowell, Mass.	111 Chestnut Street
Greene, John Lester, VI, Lowell, Mass.	388 East Merrimack Street
Jarek, Helen Jane, IV, Lowell, Mass.	74 Eleventh Street
Levin, Samuel, IV, Lowell, Mass.	43 Ware Street
Lyons, James Francis, Jr., IV, Nashua, N. H.	————
Marsden, Sidney Robert, IV, Lawrence, Mass.	Phi Psi House
Miller, Arnold Irving, IV, Lowell, Mass.	268 Shaw Street
Monahan, Harold Joseph, IV, Dorchester, Mass.	————
Murphy, Hubert James, IV, North Chelmsford, Mass.	————
O'Donoghue, Eileen Margaret, VI, Lowell, Mass.	20 Columbia Street
Oliver, Roger Barton, VI, Lowell, Mass.	62 Glenwood Street
Olsen, Herbert Charles, IV, Reading, Mass.	————
Page, Herbert Stanton, IV, Chelmsford, Mass.	————
Patsourakos, James Peter, IV, Lowell, Mass.	619 Market Street
Prescott, William Benjamin, IV, Westford, Mass.	————
Reddish, Thomas Warren, IV, Cincinnati, Ohio	Phi Psi House
Reed, Everett Carlton, VI, Chelmsford, Mass.	————
Reed, William Thorncroft, VI, Lowell, Mass.	617 Westford Street
Ritchie, Newell Baird, IV, Concord, N. H.	————
Roth, Paul, VI, Brooklyn, N. Y.	43 Plymouth Street
Rowntree, Clyde Burton, IV, Lowell, Mass.	32 Lane Street
Spevack, Edward, IV, Carlstadt, N. J.	1280 Middlesex Street
Steinberg, Sidney, VI, Brooklyn, N. Y.	1280 Middlesex Street
Thomas, Henry Edward, VI, Lowell, Mass.	41 Bellevue Street
Winkler, Burton Cole, IV, Elizabeth, N. J.	Phi Psi House

Class of 1940

Aigen, Lawrence, VI, Brooklyn, N. Y.	43 Plymouth Street
Balas, Fred Frank, VI, Lowell, Mass.	196 Mt. Pleasant Street
Beltramini, Kenneth Charles, VI, West Englewood, N. J.	Phi Psi House
Brooks, Raymond King, VI, Unionville, Conn.	Omicron Pi House
Bullock, Merlen Clarke, VI, Lowell, Mass.	38 Burtt Street
Campbell, Andrew Morris, IV, Lawrence, Mass.	————
Chapman, Boyd Palmer, Jr., IV, Franklin, Mass.	Omicron Pi House
Cherr, Alda Jay, VI, New York, N. Y.	32 Mt. Washington Street
Chisholm, Kenneth, Jr., IV, Medford, Mass.	————
Davis, Arthur Sabin, IV, Lowell, Mass.	105 Inland Street

Home Address	*Lowell Address*
Esielionis, Victor John, VI, Shirley, Mass.	————
Falk, Stanley, VI, Brooklyn, N. Y.	123 Riverside Street
Feuerstein, James Mayer, VI, Jamaica Plain, Mass.	84 Gates Street
Fox, Louise, VI, Dracut, Mass.	————
Gill, John Schofield, IV, Andover, Mass.	————
Grothe, David Ivan, VI, Laconia, N. H.	137 Riverside Street
Haas, Alexander Robert, VI, Brooklyn, N. Y.	43 Plymouth Street
Hall, Richard Thomas, IV, Lowell, Mass.	54 Seventh Street
Hull, Robert Barney, VI, Lowell, Mass.	606 Stevens Street
Jones, Newton Adelbert, IV, Melrose, Mass.	————
Kaplan, Ralph Reuben, VI, Lowell, Mass.	43 Hawthorne Street
Kiernan, James Vincent, VI, Dracut, Mass.	————
Lanner, Arthur Williams, IV, North Tewksbury, Mass.	————
Lynch, Edward Mark, IV, Lawrence, Mass.	————
McGilly, John Seede, VI, Lowell, Mass.	16 Talbot Street
Manning, Neil Joseph, IV, Lowell, Mass.	118 Mt. Washington Street
Maslanka, Edward John Felix, IV, Lowell, Mass.	5 Hampshire Street
Meuser, Rudolph Walter, VI, Pawtucket, R. I.	Omicron Pi House
Nelson, William Arthur, IV, Lowell, Mass.	896 Westford Street
Nuttall, Andrew Frederick, IV, North Billerica, Mass.	————
Ocoma, Estanislao Manaois, B.S., VI, Boston, Mass.	768 Merrimack Street
Pelt, Joseph, Jr., VI, South Orange, N. J.	Phi Psi House
Pero, Henry Leland, VI, West Willington, Conn.	Omicron Pi House
Rovner, Albert Hyman, VI, Chelsea, Mass.	————
Silberstein, Raymond, VI, Brooklyn, N. Y.	266 Gibson Street
Silverman, Joseph Melvin, VI, Winthrop, Mass.	1280 Middlesex Street
Sweatt, Safford Pershing, IV, Lowell, Mass.	124 Stevens Street
Taylor, Roy Arnold, Jr., IV, West Newton, Mass.	————
Thayer, Walter Stephen, VI, New Ipswich, N. H.	337 Beacon Street
Tuttle, Kendall Chapin, VI, Groton, Mass.	————
Upton, George Joseph, IV, Fitchburg, Mass.	————
Wolf, Irving Jacob, VI, Lowell, Mass.	218 Gibson Street
Woodard, Malcolm Russell, IV, Chelmsford, Mass.	————
Zarules, George, IV, Peabody, Mass.	48 Claire Street

Class of 1941

Adie, Donald Miles, VI, Lowell, Mass.	26 Otis Street
Alexander, Gerard, VI, Kew Gardens, L. I., N. Y.	43 Plymouth Street
Atwell, Ralph Gilmore, VI, Dracut, Mass.	————
Bardzik, Thaddeus, IV, Dracut, Mass.	————
Batcheller, Ben Pitman, IV, Andover, Mass.	————
Biron, Joan Marguerite, VI, Lowell, Mass.	56 Fairlawn Street
Brown, Needham Ballou, Jr., VI, Andover, Mass.	————
Buzidragis, Joseph Francis, IV, Lowell, Mass.	93 Davidson Street
Campbell, John Duncan, VI, South Boston, Mass.	37 Varney Street
Caraganis, Nicholas Lewis, VI, Dracut, Mass.	————
Carmichael, Robert Dana, VI, Andover, Mass.	————
Casavant, Kenneth Arthur, IV, Gardner, Mass.	66 Riverside Street
Condon, John Andrew, Jr., IV, North Billerica, Mass.	————
Cordeau, George Edward, IV, Lowell, Mass.	1014 Lakeview Avenue
Curtin, Thomas Emmet, IV, Lowell, Mass.	49 Second Street
Demitropoulos, Andrew Peter, VI, Dracut, Mass.	————
Dubrule, Louis Joseph, IV, Lawrence, Mass.	————
Epstein, Edward Joseph, IV, Newark, N. J.	137 Riverside Street
Finard, Saunder, IV, Revere, Mass.	242 Hildreth Street

Home Address	Lowell Address
Finn, Charles Anthony, IV, Milton, Mass.	Phi Psi House
Flood, Edward Robert, IV, Lowell, Mass.	118 Bartlett Street
Fortier, George Charles, IV, Dracut, Mass.	———
Gari, Jose Via, VI, Mexico City, Mexico	9 White Street
Garnett, Stanley Arthur, IV, Edgewood, R. I.	137 Riverside Street
Garrity, Edward Leo, IV, Lowell, Mass.	366 Parker Street
Gass, Matthew, IV, Lowell, Mass.	201 Hildreth Street
Gatzimos, Aristophanes, IV, Lowell, Mass.	17 Little Street
Ginivan, William Francis, IV, Lowell, Mass.	50 Lamb Street
Greenbaum, Bernard Saul, IV, Haverhill, Mass.	———
Grondin, Abraham Hector, IV, Lowell, Mass.	111 Alma Street
Guilfoyle, Donald William, VI, Providence, R. I.	337 Beacon Street
Halaby, William Edwin, VI, Medellin, Colombia, S. A.	15 Douglas Road
Hamilton, Arthur Theodore, VI, Pittsfield, Me.	337 Beacon Street
Higginbottom, George Stephen, IV, Lowell, Mass.	46 Otis Street
Inkpen, Norman Alfred, IV, Ward Hill, Mass.	———
James, Ernest Peter, IV, Haverhill, Mass.	———
Jay, Joshua Daniel, VI, Brooklyn, N. Y.	142 Riverside Street
Joyce, Herbert Milton, VI, Mountain Side, N. J.	43 Plymouth Street
Keizer, Miriam Eileen, IV, Westford, Mass.	———
Kennedy, John Francis, IV, Lowell, Mass.	20 Bertha Street
Koulas, Stanley Charles, IV, Chelmsford, Mass.	———
Landfield, Harold, IV, Dorchester, Mass.	445 High Street
Lane, Joseph James, VI, Webster, Mass.	337 Beacon Street
Lannon, John Francis, Jr., IV, Saylesville, R. I.	53 Mt. Hope Street
Leary, Gordon Simpson, IV, Lowell, Mass.	834 Andover Street
Lewis, Dorothy Elaine, VI, Chelmsford, Mass.	———
Linden, Leo, VI, Chelsea, Mass.	———
McCaffrey, Joseph Fredrick, IV, Dracut, Mass.	———
McMahon, Joseph Justin, IV, Lowell, Mass.	7 Belmont Street
McTeague, George David, IV, Lowell, Mass.	298 Riverside Street
Mahan, Frederick Joseph, IV, Lowell, Mass.	825 Chelmsford Street
Mahoney, Francis Vincent, Jr., North Billerica, Mass.	———
Mason, Frederick Rufus, VI, Glendale, R. I.	64 Orchard Street
Milberg, Maurice, VI, Bronx, N. Y.	75 Fourth Avenue
Mintz, Irving Paul, IV, Passaic, N. J.	137 Riverside Street
Molchan, Stanley Charles, VI, Lawrence, Mass.	———
Morse, Arthur George, VI, East Woodstock, Conn.	137 Riverside Street
Murphy, Francis Arthur, IV, Brookline, Mass.	———
Noonan, Arthur Thomas, IV, Dorchester, Mass.	———
Okun, Seymour, VI, Brooklyn, N. Y.	337 Beacon Street
Paley, Herbert Melvin, IV, Haverhill, Mass.	———
Patrick, Stephen Edmund, Jr., VI, Augusta, Me.	343 Wilder Street
Pernick, David, VI, New York, N. Y.	142 Riverside Street
Phillips, Maurice Gordon, VI, Southbridge, Mass.	337 Beacon Street
Platt, Walter Wallace, IV, Lawrence, Mass.	———
Portilla, Jose Luis, VI, Mexico, D. F., Mexico	9 White Street
Puliafico, Salvatore Joseph, IV, Barre Plains, Mass.	59 Crescent Street
Rashkin, Bernard, VI, Brooklyn, N. Y.	19 Mt. Hope Street
Rich, Charlotte Merline, IV, Haverhill, Mass.	———
Roberts, Angus Henry, IV, Lowell, Mass.	35 Wiggin Street
Roberts, Gerald Adrien, IV, Millbury, Mass.	20 Crawford Street
Roux, Frank George, IV, New York, N. Y.	Phi Psi House
Sakelaris, Dionysius John, IV, Lowell, Mass.	78 Varney Street
Saltsman, Sidney Irving, IV, Lowell, Mass.	89 Washington Street

Home Address	*Lowell Address*
Scarmeas, Harry George, IV, Lowell, Mass.	21 Hancock Avenue
Schwartzmann, Moises, IV, Mexico D. F., Mexico	9 White Street
Shore, James Cooper, IV, Pawtucket, R. I.	359 Beacon Street
Siegler, Frank Anthony, VI, Methuen, Mass.	———
Skalkeas, Basil George, IV, Lowell, Mass.	53 Avon Street
Sullivan, Paul John, IV, Lowell, Mass.	33 South Walker Street
Szymosek, Frank John, IV, North Andover, Mass.	———
Tartikoff, Jordan Alvin, VI, Brooklyn, N. Y.	19 Mt. Hope Street
Tattersall, James, VI, West Roxbury, Mass.	———
Urlaub, George Samuel, IV, Queens Village, N. Y.	43 Plymouth Street
Webb, Ralph Peabody, VI, Dracut, Mass.	———
Weil, Clarence Bernard, IV, New York, N. Y.	148 Riverside Street
Woodard, Alice Marjorie, VI, Chelmsford, Mass.	———
Zellweger, Ralph John, VI, Palisade, N. J.	53 Mt. Hope Street

Diploma Students

Class of 1938

Ekstrand, Frederic Lawrence, II, Stafford Springs, Conn.	Phi Psi House
Foss, George Woodrow, II, Haverhill, Mass.	———
Kane, Roger Hugh, II, Cherry Valley, Mass.	75 Fourth Avenue
Kareores, Gregory George, II, Lowell, Mass.	52 Lewis Street
LaBonte, Andrew Shea, II, Lawrence, Mass.	———
Lehto, Reino Gust, III, Maynard, Mass.	———
Pease, Kilburn Gray, I, Lowell, Mass.	337 Beacon Street

Class of 1939

Bauer, Frank Norbert, I, Waterloo, Ont.	226 Riverside Street
Cohen, Leonard Lee, II, Rochester, N. Y.	148 Riverside Street
Daun, Shin-Yuan, B.A., II, Wusih, Kiangsu, China	53 Mt. Hope Street
Gay, Clarence Russel, III, Lowell, Mass.	140 Methuen Street
Hackett, John James, II, Groton, Mass.	———
Hockmeyer, Clive Edward, Jr., I, Lowell, Mass.	7 Whitman Street
Li, Kwoh-Chang, B.A., II, Wusih, Kiangsu, China	53 Mt. Hope Street
Little, Ralph Harding, II, Rockville, Conn.	Omicron Pi House
Merritt, Charles Adelbert, II, Rockland, Me.	Omicron Pi House
Rees, Richard Holmes, I, Newtonville, Mass.	———
Scribner, James Woodbury, II, Manchester, N. H.	Omicron Pi House
Stowell, Eldon, A.B., I, Williamstown, Mass.	8 Mt. Washington Street
Wheelock, Silas Mandeville, Jr., II, Putnam, Conn.	Omicron Pi House
White, Robert Gordon, II, Worcester, Mass.	Phi Psi House
Wiesner, Arthur Charles, II, Lawrence, Mass.	———

Class of 1940

Baker, Ernest Paul, II, Auburn, Me.	1980 Middlesex Street
Finn, Joseph Francis, II, Milton, Mass.	Phi Psi House
Melinas, Lionel Aime, II, Woonsocket, R. I.	81 School Street
Hobson, Edward Shackford, I, Southbridge, Mass.	337 Beacon Street
Mackle, Chauncey Jacob, II, Cranston, R. I.	53 Mt. Hope Street
Moran, James Robert, II, Nashua, N. H.	———
Proulx, Arthur Anthony, II, Claremont, N. H.	65 Sterling Street
St. Jean, Lawrence Raymond, II, Harrisville, R. I.	226 Riverside Street
Snow, David Charles, II, Townshend, Vt.	43 Plymouth Street
Striar, Max Gordon, II, Bangor, Me.	1280 Middlesex Street
Worsfold, Jay Moody, II, Waltham, Mass.	———
Yacubian, Gamaliel Mardiros, II, Somerville, Mass.	———

Specials

Home Address	*Lowell Address*
Allaire, Alexander Hector, IV, Woonsocket, R. I.	793 Merrimack Street
Argersinger, Clarence Daniel, II, Lowell, Mass.	Omicron Pi House
Brodsky, William, B.S., VI, New York, N. Y.	142 Riverside Street
Currier, Arthur Melvin, I, Montclair, N. J.	Omicron Pi House
Dibble, Condit Humphrey, II, North Adams, Mass.	11 White Street
Dul, John, III, Lawrence, Mass.	———
Fletcher, James Richard, III, Hamilton, Ont.	786 Merrimack Street
Goldstein, Seymour, II, New York, N. Y.	100 Riverside Street
Hall, George Tait, B.A., VI, Wilton, Conn.	137 Riverside Street
Harrington, John Edward, B.S., VI, Lawrence, Mass.	———
Hastings, Elizabeth Ashley, III, South Yarmouth, Mass.	142 Princeton Street
Hird, Arthur Dean, VI, Lowell, Mass.	35 Burnaby Street
Karpowich, Stanley, III, Methuen, Mass.	———
McCusker, Thomas Bernard, Jr., A.B., III, East Braintree, Mass.	———
Malyn, Theodore Gregory, III, Lawrence, Mass.	———
Manty, Frederick William, III, Maynard, Mass.	———
Maxwell, Elsie Gage, B.A., III, Butler, Pa.	115 Nesmith Street
Maxwell, William Thomas, B.S., M.B.A., VI, Butler, Pa.	115 Nesmith Street
Navas, Matilda Marcella, III, Lawrence, Mass.	———
O'Connor, John Terrence, III, Woburn, Mass.	———
O'Donoghue, John Kew, VI, Lowell, Mass.	84 Florence Avenue
Peterson, Albert Cobb, III, Rockland, Me.	Omicron Pi House
Reed, George Blake, VI, Lowell, Mass.	617 Westford Street
Riley, David Vincent, VI, Lowell, Mass.	591 Wilder Street
Rudner, Bernard, III, West Springfield, N. H.	———
Safford, Charles Louis, A.B., VI, Lowell, Mass.	266 Andover Street
Scanlon, Joseph Cornelius, II, Lawrence, Mass.	———
Simoneau, Wilfred, III, Lawrence, Mass.	———
Sluski, John Sergi, III, Maynard, Mass.	———
Spaulding, Edward Lee, III, Billerica, Mass.	———
Weintraub, Paul Lawrence, Jr., B.S., VI, Philadelphia, Pa.	343 Princeton Street
Wessells, Joseph Francis, IV, Lowell, Mass.	31 England Street
White, Robert Hedges, B.S., VI, Medford, Mass.	———
Wilkinson, Freeman Firth, I, Thompson, Conn.	Omicron Pi House
Zalis, John Henry, III, Canton, Mass.	———

ALPHABETICAL LIST OF GRADUATES

Master of Science degree was first given in 1936. Other degrees were issued beginning with the year 1913 as follows: B.T.C.—Bachelor of Textile Chemistry; B.T.D.—Bachelor of Textile Dyeing; B.T.E.—Bachelor of Textile Engineering. A diploma is indicated by D and a certificate (covering a partial course only) by C.

The following list has been corrected in accordance with information received previous to February 1, 1938. Any information regarding incorrect or missing addresses is earnestly solicited.

Abbot, Edward Moseley, II, '04 (D). President and General Manager, Abbot Worsted Company, Graniteville, Mass.
Abbott, George Richard, II, '08 (D). Andover, Mass.
Adams, Floyd Willington, VI, '16 (B.T.E.).
Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.
Adams, Tracy Addison, IV, '11 (D). Vice-President, Arnold Print Works, North Adams, Mass.
Albrecht, Charles Henry, IV, '17 (B.T.C.). Chief Chemist, Atlantic Mills, Providence, R. I.
Alcott, Albert Stephen, Jr., IV, '35 (B.T.C.), '36 (M.S.). With New England Telephone & Telegraph Co., Lawrence, Mass.
Allard, Edward Joseph, IV, '31 (B.T.C.). Salesman and Demonstrator, National Aniline & Chemical Company, Providence, R. I.
Allen, Grover Stanley, IV, '34 (B.T.C.). With M. T. Stevens & Sons Co., Haverhill, Mass.
Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.
Anderson, Arthur Illman, IV, '24 (B.T.C.). Textile Chemist, Superintendent of Research, American Institute of Laundering, Joliet, Ill.
Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City.
Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Hathaway Manufacturing Company, New Bedford, Mass.
Anderson, Harold Robert, II, '26 (D). With Abbot Worsted Company, Forge Village, Mass.
Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.
Anthony, Henry Steere, Jr., IV, '36 (B.T.C.). Assistant Chemist, Tyer Rubber Company, Andover, Mass.
Appel, Mrs. Bessie L. (Lifland, Bessie), IV, '32 (B.T.C.). Assistant Chemist, Massachusetts Knitting Mill, Jamaica Plain, Mass.
Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Superintendent of Dyeing, Sayles Finishing Plants, Inc., Saylesville, R. I.
Arundale, Henry Barnes, II, '07 (D). Test and Research Engineer, Atwood Machine Company, Stonington, Conn.
Atwood, Henry Jones, II, '23 (D). Agent, Amos Abbott Company, Dexter, Me.

Babb, Charles Wilkes, Jr., II, '31 (D). With Knox Woolen Company, Camden, Maine.
Babigan, Edward, IV, '33 (B.T.C.). With Outlet Fruit Company, Lowell, Mass.
Babigan, Raymond, IV, '24 (B.T.C.). Associate Examiner, United States Patent Office, Washington, D. C.
Bachelder, Charles Edward, IV, '24 (B.T.C.). Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.
Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). Time Study, Worsted Division, Pacific Mills, Lawrence, Mass.
Bailey, Lester Harold, IV, '24 (B.T.C.). Chemist, United States Finishing Company, Providence, R. I.
Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.
Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.
Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.
Baker, William John, IV, '16 (D). Supervisor, DuPont Rayon Company, Old Hickory, Tenn.
Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.

Balch, Ralph Herman, VI, '29 (B.T.E.). Development Engineer, Celanese Corporation of America, Amcelle, Md.

Baldwin, Frederick Albert, II, '04 (D). President, Federal Clothing Manufacturing Company, Ltd., Sherbrooke, Que.

Bard, Morry Arnold, IV, '30 (B.T.C.). President, Silver Line Dye Works, Inc., New York City.

Barlofsky, Archie, VI, '17 (B.T.E.). Attorney at law, Barlofsky & Barlofsky, Lowell, Mass.

Barr, I. Walwin. I, '00 (D). Vice-President, Buckley Brothers Company, 881 Broadway, New York City.

Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co. (Industrial Soap Division), North Bergen, N. J.

Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.

Barry, Marie Gertrude, IV, '32 (B.T.C.). In Charge of Fastness Tests, National Aniline & Chemical Co., Buffalo, N. Y.

Basdikis, Charles Apostolos, IV, '36 (B.T.C.). 8 Lagrange Street, Lowell, Mass.

Bassett, Louis Loss, VI, '37 (B.T.E.). Salesman, Arthur J. Feinberg, 222 Summer Street, Boston, Mass.

Bates, Wesley Elliot, VI, '36 (B.T.E.). Experimental Department, Saco-Lowell Shops, Biddeford, Me.

Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.

Beattie, John Silas, IV, '35 (B.T.C.). Textile Research Chemist, Ridgway, Whiting & Bodenschatz, Inc., Nutley, N. J.

Beck, Frederic Christian, II, '24 (D). In business, Weld & Beck, Southbridge, Mass.

Beeman, Earl Royal, VI, '30 (B.T.E.). Overseer, Pacific Mills, Dover, N. H.

Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline & Chemical Company, Buffalo, N. Y.

Bell, Edward Benjamin, IV, '24 (B.T.C.). Sales and Service, Calgon, Inc., Pittsburgh, Pa.

Bennett, E. Howard, II, '03 (C). Publisher, American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass.

Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.

Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.

Berry, Wilbur French, II, '17 (D).

Bertrand, Arthur Leon, IV, '32 (B.T.C.). Dyeing Department, United States Bunting Company, Lowell, Mass.

Bienstock, George Jerrard, III, '24 (D). Styler and Designer, Yorkshire Worsted Mills, New York, N. Y.

Billings, Borden Dickinson, I, '29 (D). Designer, Atlanta Woolen Mills, Atlanta, Ga.

Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.

Bird, Francis John, VI, '22 (B.T.E.). Attorney-at-Law, 227 Bronson Building, Attleboro, Mass.

Birtwell, John Lincoln, IV, '34 (B.T.C.). Field Engineer, Armour Soap Works, North Bergen, N. J.

Blaikie, Howard Mills, II, '11 (D). Salesman, Kitchen Kraft Food Corporation, Brooklyn, N. Y.

Blake, Parker Gould, VI, '14 (D). Partner, Parker Blake & Clinton Long, Ltd., 54 Wellington Street, West, Toronto, Ont.

Blanchard, John Lawrence, II, '23 (D). Designer, Farnsworth Company, Lisbon Centre, Me.

Bodwell, Henry Albert, II, '00 (D). Assistant Selling Agent, Ludlow Manufacturing and Sales Company, 211 Congress Street, Boston, Mass.

Bogdan, John Francis, VI, '35 (B.T.E.). With Manville Jenckes Corporation, Manville, R. I.

Boordetsky, Sidney Morris, VI, '37 (B.T.E.). With Malden Knitting Mills, Malden, Mass.

Booth, James Mooney, IV, '24 (B.T.C.). Technical Salesman, The Huron Milling Company, 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Styler, Joshua L. Bailey & Co., 10-12 Thomas Street, New York City.

Boynton, Bradford Lewis, II, '35 (D). With Munro, Kincaid, Edgehill, Inc., Boston, Mass.

Brackett, Martin Richard, II, '22 (D). Selling Agent, 450 7th Avenue, New York City.

Bradford, Edward Hosmer, VI, '35 (B.T.E.). Research, Carding Department, Manville-Jenckes Corporation, Manville, R. I.

Bradford, Harold Palmer, II, '25 (D).
Bradford, Roy Hosmer, II, '06 (D). Selling Agent, Textile Machinery, 161 Devonshire Street, Boston, Mass.
Bradford, William Swanton, VI, '31 (B.T.E.). 138 Main Street, Andover, Mass.
Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.
Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.
Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, 325 West Huron Street, Chicago, Ill.
Brainerd, Carl Emil, IV, '20 (B.T.C.). Dyer, F. C. Huyck & Sons, Albany, N. Y.
Brandt, Carl Dewey, VI, '20 (B.T.E.). Research Engineer, Whitin Machine Works, Whitinsville, Mass.
Brannen, Leon Vincent, III, '07 (C).
Brickett, Chauncy Jackson, II, '00 (D). Director, Schools of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.
Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.
Bridges, Herbert Gardner, II, '34 (D). Unit Manager, Commercial Credit Corporation, Manchester, N. H.
Brigham, Howard Mason, VI, '24 (B.T.E.). Salesman, Wellington, Sears Co., 65 Worth Street, New York City.
Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.
Brosnan, William Francis, IV, '27 (B.T.C.). Overseer of Dyeing, Bradford Dyeing Association, Bradford, R. I.
Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.
Brown, Philip Franklin, II, '23 (D). Assistant Sales Director, E. I. DuPont de Nemours, Rayon Division, Wilmington, Del.
Brown, Rollins Goldthwaite, IV, '12 (D).
Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.
Brown, Will George, Jr., IV, '22 (B.T.C.). Sales Technologist, Wallerstein Company, 180 Madison Avenue, New York City.
Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.
Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.
Bukala, Mitchell John, IV, '34 (B.T.C.). With Massachusetts Mohair Plush Company, Lowell, Mass.
Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.
Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.
Burke, James Edward, Jr., IV, '34 (B.T.C.). With Newmarket Manufacturing Company, Lowell, Mass.
Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous, Inc., Lawrence, Mass.
Burns, Robert, IV, '28 (B.T.C.).
Burtt, Joseph Frederic, VI, '31 (B.T.E.). With Abbot Worsted Company, Forge Village, Mass.
Buzzell, Harry Saville, VI, '29 (B.T.E.). Supervisor of Sample Department, Oxford Paper Company, Rumford, Maine.

Calder, Marian Brownson, VI, '37 (M.S.). (B.S. 1930, College of Industrial Arts, Texas State College for Women.) Teacher, Centenary Junior College, Hackettstown, N. J.
Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.
Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.
Campbell, Alexander, VI, '23 (B.T.E.). Assistant Engineer, Arlington Mills, Lawrence, Mass.
Campbell, Allan, Jr., VI, '32 (B.T.E.). With A. & A. Campbell Co., South Boston, Mass.
Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place, Boston, Mass.
Campbell, Orison Sargent, II, '03 (D). Managing Director, Industrial Felts, Ltd., Kitchener, Ont.

Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Manager, Carlton Hotel, Malden, Mass.

Carbone, Alfred John, IV, '31 (B.T.C.). Chemist, Sandoz Chemical Works, 63 Oliver Street, Boston, Mass.

Carleton, Joseph Raddin, III, '30 (D). Designer, Bridgeport Fabrics, Inc., Bridgeport, Conn.

Carr, George Everett, I, '05 (D). Industrial Engineer, C. F. Mueller Company, 180 Baldwin Avenue, Jersey City, N. J.

Carr, Paul Edward, II, '24 (D). Styler, Deering, Milliken & Co., 450 Seventh Avenue, New York City.

Carter, Robert Albion, IV, '02 (D). District Manager, DuPont Dyestuffs, E. I. du Pont de Nemours & Co., Birdsboro, Pa.

Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.

Cary, Julian Clinton, VI, '10 (D). Branch Manager, The American Mutual Liability Insurance Company, 12 Haynes Street, Hartford, Conn.

Casey, Francis Harold, IV, '31 (B.T.C.). With Sandoz Chemical Works, Inc., Boston, Mass.

Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton, N. J.

Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.

Chandler, Proctor, IV, '11 (D). Manager, Barbour Mills, Montello, Mass.

Chang, Chi, VI, '23 (B.T.E.).

Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Spinning & Weaving Co., 392 Nanking Road, Shanghai, China.

Chapman, Leland Hildreth, VI, '24 (B.T.E.). Pepperell, Mass.

Chen, Shih Ching, IV, '22 (B.T.C.).

Chen, Wen-Pei, IV, '24 (B.T.C.). Shanghai Bureau of Inspection, Shanghai, China.

Church, Charles Royal, II, '06 (C). Teacher and Athletic Coach, San Diego High School, San Diego, Calif.

Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.

Clark, Earl William, IV, '18 (B.T.C.). 231 Anderson Place, Buffalo, N. Y.

Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.

Clarke, George Dean, II, '21 (C). 338 East Main Street, Avon, Mass.

Clayton, Harold Edmund, VI, '21 (B.T.E.). Manager, Clayton Hosiery Mills, Inc., Lowell, Mass.

Cleary, Charles Joseph, II, '13 (D). Textile Technologist, United States Army Air Corps, Dayton, Ohio.

Clement, David Scott, IV, '24 (B.T.C.). Overseer of Dyeing, Nashua Manufacturing Company, Nashua, N. H.

Cleveland, Richard Sumner, VI, '30 (B.T.E.). Assistant Textile Technologist, National Bureau of Standards, Washington, D. C.

Clifford, Albert Chester, VI, '22 (B.T.E.). Textile Engineer, Western Electric Company, Inc., Kearny, N. J.

Clogston, Raymond B., IV, '04 (D). Divisional Superintendent of Dyeing, Merrimack Manufacturing Company, Lowell, Mass.

Cluett, John Girvin, I, '29 (D). Foreman of Examining at Bleachery, Cluett, Peabody & Co., Inc., Waterford, N. Y.

Coan, Charles Bisbee, IV, '12 (D). Salesman and Demonstrator, American Aniline Products Company, Boston, Mass.

Cobb, Joseph Calvin, VI, '36 (B.T.E.). With Thermoid Company, Trenton, N. J.

Coffey, Daniel Joseph, III, '28 (D). Blanket Inspector, F. C. Huyck & Sons, Rensselaer, N. Y.

Cohen, Arthur Edward, IV, '23 (B.T.C.). With National Hosiery Dyeing and Finishing Works, Boston, Mass.

Cohen, Raphael Edvab, IV, '25 (B.T.C.). Sales Manager, Merrimack Paper Tube Company, Inc., Lowell, Mass.

Colby, J. Tracy, VI, '16 (D). Sales Manager, F. C. Huyck & Sons, Empire State Building, Room 3006, New York City.

Colby, Willard Alvah, Jr., IV, '30 (B.T.C.). Assistant Superintendent, Hohokus Bleachery, Hohokus, N. J.

Cole, Edward Earle, IV, '06 (D). 191 Merrimack Street, Haverhill, Mass.

Collonan, Herbert Joseph, II, '22 (D). With Potter & Collonan, Moosup, Conn.

Coman, James Groesbeck, I, '07 (D). Manager, Mexia Textile Mills, Mexia, Texas.

Conant, Harold Wright, I '09 (D). Assistant Treasurer, United Elastic Corporation, Easthampton, Mass.

Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears Company, 65 Worth Street, New York City.

Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.

Connolly, Daniel Francis, Jr., VI, '35 (B.T.E.). With Naumkeag Steam Cotton Company, Salem, Mass.

Connor, Thomas Francis, II, '28 (D). North Cohasset, Mass.

Connorton, John Joseph, Jr., III, '27 (D).

Cook, Kenneth Bartlett, I, '13 (D). Vice-President in Charge of Manufacturing, Manville-Jenckes Company, Manville, R. I.

Corbett, James Francis, IV, '28 (B.T.C.). Chemist, Pacific Mills, Lawrence, Mass.

Cote, Theodore Charles, IV, '26 (B.T.C.). Chemist, Merrimack Manufacturing Company, Lowell, Mass.

Cowan, Raymond Bernard, IV, '35 (B.T.C.).

Craig, Albert Wood, IV, '07 (D). Superintendent, Windsor Print Works, North Adams, Mass.

Craig, Clarence Eugene, III, '02 (D). 1730 Centre Street, West Roxbury, Mass.

Crane, Eugene Francis, II, '33 (D). 67 Loring Street, Lowell, Mass.

Crawford, Robert Thomas, VI, '36 (B.T.E.). Development Engineer, Tennessee Eastman Corporation, Kingsport, Tenn.

Creese, Guy Talbot, IV, '14 (D). Leather Manufacturer, Creese & Cook Company, Danversport, Mass.

Crowe, Joseph Bailey, IV, '25 (B.T.C.). Director of Laundry and Textile Research, Procter & Gamble Co., Ivorydale, Ohio.

Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.

Cummings, Edward Stanton, VI, '16 (D). Industrial Engineer, Ralph E. Loper & Co., Greenville, S. C.

Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.

Currier, Herbert Augustus, I, '06 (D). Vice-President, Waterman, Currier & Co., Inc., 40 Worth Street, New York City.

Currier, John Alva, II, '01 (D). Superintendent of Fabrics Department, M. T. Stevens & Sons Co., North Andover, Mass.

Curtin, William John, IV, '35 (B.T.C.). Insurance Agent, John Hancock Mutual Life Insurance Company, Lowell, Mass.

Curtis, Frank Mitchell, I, '06 (D). Retail Lumber, Wm. Curtis Sons Company, 10 Blue Hill Parkway, Milton, Mass.

Curtis, William Leavitt, II, '05 (C).

Cutler, Benjamin Winthrop, Jr., III, '04 (D). Department Manager, Worth Textile Company, 40 Worth Street, New York City.

Cuttle, James H., II, '99 (D). Director, S. Stroock & Co., Inc., Newburgh, N. Y.

Daley, Charles Lincoln, IV, '34 (B.T.C.). With National Aniline & Chemical Co., Buffalo, N. Y.

Dalton, Gregory Smith, IV, '12 (D).

Daly, William James, VI, '37 (B.T.E.). Executive Training Group, Sears-Roebuck Company, Cambridge, Mass.

Danahy, Arthur Joseph, IV, '31 (B.T.C.). Chemist, Ciba Company, Inc., 325 West Huron Street, Chicago, Ill.

Darby, Avard Nelson, II, '28 (D). Superintendent, Plant No. 2, Merrimac Hat Corporation, Amesbury, Mass.

Datar, Anant Vithal, VI, '24 (B.T.E.). Manager, The Chalisgaon Shri Laxmi Narayan Mills Co., Ltd., Chalisgaon, E.K., India.

Davidson, Sydney, III, '28 (D). 301 Allston Street, Brighton, Mass.

Davieau, Alfred Edward, VI, '16 (D). Chief of Textile Section, United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J.

Davieau, Arthur Napoleon, VI, '13 (D). Superintendent, Kenwood Mills, Ltd., (F. C. Huyck & Sons), Arnprior, Ont.

Davieau, Leon Arthur, VI, '23 (B.T.E.). With United States Rubber Products, Inc., Market and South Streets, Passaic, N. J.

Davis, Alexander Duncan, VI, '14 (B.T.E.). Instructor, Northeastern University, Springfield, Mass.

Dearborn, Roy S., VI, '13 (D). With Real Estate Department, Andover Savings Bank, Andover, Mass.

deGruchy, James Campbell, Jr., IV, '36 (B.T.C.). Chemist and Dyer, Goodall Worsted Company, Sanford, Me.

Del Plaine, Parker Haywood, IV, '25 (B.T.C.). Southern Manager, Rohm & Hass Company, Inc., 1109 Independent Building, Charlotte, N. C.
Dempsey, Phillip Edward, IV, '33 (B.T.C.). Chemist, American Aniline Products, Inc., Boston, Mass.
Derby, Roland Everett, IV, '22 (B.T.C.). Chemist, M. T. Stevens & Sons Company, North Andover, Mass.
de Sa, Francisco, VI, '18 (B.T.E.). Avenue da Graca, Bahia, Brazil.
Dewey, James French, II, '04 (D). President and Treasurer, A. G. Dewey Company, Quechee, Vt.
Dewey, Maurice William, II, '11 (D). Inspector of Real Estate, National Life Insurance Company, Montpelier, Vt.
Dillon, James Henry, III, '05 (D).
Dion, Ernest Lorenzo, IV, '35 (B.T.C.). With Pacific Mills, Worsted Division, Lawrence, Mass.
Dods, James Barber, II, '27 (D). Vice-President, The Dods Knitting Company, Ltd., Orangeville, Ont.
Dolan, William Francis, IV, '28 (B.T.C.).
Donald, Albert Edward, II, '04 (D). Agent, H. T. Hayward Company, Franklin, Mass.
Donohoe, Edward Joseph, VI, '34 (B.T.E.). Textile Engineer, United States Testing Company, Inc., Hoboken, N. J.
Donovan, Joseph Richard, IV, '24 (B.T.C.). 81 Strathmore Road, Brookline, Mass.
Doran, Wilbur Kirkland, II, '22 (D).
Dorr, Clinton Lamont, VI, '14 (D). General Manager, Raymond's, Inc., 356 Washington Street, Boston, Mass.
Douglas, Walter Shelton, II, '21 (D). Estimator, Douglas & Co., Lowell, Mass.
Dudley, Albert Richard, VI, '33 (B.T.C.). With Chicopee Manufacturing Corporation, Manchester, N. H.
Duggan, Paul Curran, IV, '31 (B.T.C.). Chemist, Gotham Silk Hosiery Company, 580 First Avenue, New York City.
Duguid, Harry Wyatt, I, '24 (D). Assistant Superintendent, Maverick Mills, East Boston, Mass.
Dunlap, Kirke Harold, Jr., VI, '30 (B.T.E.). Textile Engineer, Kenwood Mills, Ltd., Arnprior, Ont.
Dunlap, Parker Frank, VI, '34 (B.T.E.). Textile Engineer, Chicopee Manufacturing Corporation, Chicopee Falls, Mass.
Dunnican, Edward Tunis, VI, '24 (B.T.E.). Instructor in Textile Work, Passaic Public Schools, Passaic, N. J.
Durgin, William Ernest, IV, '24 (B.T.C.). Textile Colorist, Geigy Company, Inc., 88 Broad Street, Boston, Mass.
Dursin, Louis Jules, II, '36 (D). Superintendent, Rochambeau Worsted Company, Olneyville, R. I.
Duval, Joseph Edward, II, '10 (D). Sales Manager, Massachusetts Mohair Plush Company, 3701 North Broad Street, Philadelphia, Pa.
Dwight, John Francis, Jr., II, '08 (D). Hazel Avenue, Scituate, Mass.

Echavarria, Luis, VI, '35 (B.T.E.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia.
Echecopar, Jesus Fortunato, VI, '33 (B.T.E.). Director-Gerent de Eguren, Echecopar y Cia. S.A. and Profesor de Tecnologia Textil en la Escuela de Ingenieros, Lima, Puer.
Echmalian, John Gregory, VI, '16 (B.T.E.). Director, State Trade School, Manchester, Conn.
Ehrenfried, Jacob Benjamin, II, '07 (C). District Manager, Maine State Employment Service, Lewiston, Me.
Eismann, Edmund, IV, '35 (B.T.C.). Assistant Chemist, B. B. &. R. Knight Corporation, Pontiac, R. I.
Elliott, Gordon Baylies, II, '12 (D). Planning Department, Pacific Mills, Lawrence, Mass.
Ellis, Charles Albert, VI, '21 (B.T.E.). 901 Danforth Street, Syracuse, N. Y.
Ellis, Dorothy Myrta, VI, '25 (B.T.E.). Agricultural Economist, Department of Agriculture, Washington, D. C.
Ellis, James Oliver, VI, '29 (B.T.E.).
Engstrom, Karl Emil, VI, '12 (D). (S.B. 1916, Massachusetts Institute of Technology.) 36 Fairfield Street, Boston, Mass.
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Fairbanks, Almonte Harrison, II, '09 (D). President and Manager, Fairwood Knitting Mills, Wakefield, Mass.
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Feinberg, Benjamin, II, '27 (D). With Copley Realty Company, Boston, Mass.
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Hanscom, Edwin Thomas, II, '27 (D). Hartford, Vt.
Hardie, Newton Gary, I, '23 (D). General Superintendent, Chadwick Hoskins Company, Charlotte, N. C.
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Harmon, Charles Francis, I, '99 (D).
Harrington, Thomas, IV, '15 (D). President, Hart & Harrington, 925 Weed Street, Chicago, Ill.
Harris, Charles Edward, I, '05 (D). Superintendent, Martin Trailer Company, Westfield, Mass.

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Hart, Arthur Norman, IV, '19 (B.T.C.).
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Harwood, Ralph, IV, '35 (B.T.C.).
Haskell, Walter Frank, IV, '02 (D). Overseer of Dyeing, Dana Warp Mills, Westbrook, Maine.
Hassett, Paul Joseph, IV, '12 (D). With L. C. Smith & Corona Typewriters, Inc. Cortland, N. Y.
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Hoffman, Richard Robert, II, '21 (C).
Holbrook, Ralph Wentworth, IV, '29 (B.T.C.). Chief Chemist and Chemical Purchasing Agent, Crompton Company, West Warwick, R. I.
Holden, Arthur Newton, VI, '36 (B.T.E.). Research, Chicopee Manufacturing Corp., Manchester, N. H.
Holden, Francis Crawford, IV, '09 (D).
Holden, John Sanford, II, '20 (D). Manufacturer, Automatic Machine Products Company, Attleboro, Mass.
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Huising, Geronimo Huerva, I, '08 (D).

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Lifland, Abraham, IV, '31 (B.T.C.). Assistant Dyer, Artistic Dyeing Company, Brooklyn, N. Y.
Lifland, Bessie, IV, '32 (B.T.C.). See Appel, Mrs. Bessie L.
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Lillis, Marvin Hale, IV, '14 (D). 40 Lawrence Street, Lawrence, Mass.
Lincoln, Charles Ernest, IV, '37 (B.T.C.). With Collins & Aikman Corporation, 51st & Columbia Avenue, Philadelphia, Pa.
Lindsly, Walter Coburn, IV, '29 (B.T.C.). Chemist, Sidney Blumenthal & Co., Inc., Shelton, Conn.
Linsey, Edward, II, '25 (D).
Logan, George Leslie, VI, '28 (B.T.E.). Secretary, Tompkins Brothers Company, Syracuse, N. Y.
Lokur, Swamirao Ramrao, IV, '35 (B.T.C.).
Lombard, Carleton Joshua, VI, '23 (B.T.E.). Vice-President, Riggs & Lombard, Textile Machinery, Lowell, Mass.
Loney, Robert William, II, '22 (D). F. C. Huyck & Sons, Kenwood Mills, Albany, N. Y.
Longbottom, Parker Wyman, IV, '21 (B.T.C.). Dyer, Claremont Waste Manufacturing Company, Claremont, N. H.
Loveless, Everton Hanscom, VI, '31 (B.T.E.). Assistant Superintendent, Cotton and Rayon Division, Lorraine Manufacturing Company, Pawtucket, R. I.
Lowe, John Charles, VI, '34 (B.T.E.). Assistant Professor, Department of Worsted Yarns, Lowell Textile Institute Lowell Mass.
Lowe, Phillip Russell, VI, '24 (B.T.E.). Resident Inspector, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.
Lucey, Edmund Ambrose, II, '04 (D). Vice-President and General Manager, Glastonbury Knitting Company, Addison, Conn., and President, Glastonbury Sales Corporation, 93 Worth Street, New York City.
Lussier, Joseph Adrien, II, '27 (D). Staff Superintendent, Hood Rubber Company, Inc., Watertown, Mass.
Lyle, Robert Keith, IV, '37 (B.T.C.). Colorist, National Aniline & Chemical Co., 150 Causeway St., Boston, Mass.

McAllister, Gordon Algeo, IV, '31 (B.T.C.). North Billerica, Mass.
McCann, John Joseph, Jr., VI, '24 (B.T.E.). Engineer, McCann-Stuer, River Works, Andover, Mass.
McCool, Frank Leslie, IV, '10 (D). Resident Manager, Sandoz Chemical Works, Inc., 930 Industrial Trust Building, Providence, R. I.

Macdonald, Hector Graham, IV, '19 (B.T.C.). Superintendent of Dyeing, Franklin Process Company, Providence, R. I.
McDonald, Gerald Francis, IV, '30 (B.T.C.). Dyer and Plant Chemist, Merrimack Hat Corporation, Amesbury, Mass.
McDonald, John Joseph, IV, '32 (B.T.C.). Teacher of Testing and Dyeing, Textile High School, New York, N. Y.
McDonnell, William Henry, I, '06 (C). Court Judge, 40 Court Street, Boston, Mass.
McDougall, Francis Gerard, VI, '32 (B.T.E.). U. S. Postal Department, Lowell, Mass.
McGee, Francis Patrick, IV, '30 (B.T.C.). Teacher, Lowell High School, Lowell, Mass.
McGowan, Frank Robert, VI, '15 (B.T.E.).
McGowan, Henry Earl, VI, '22 (B.T.E.). Principal, The Oakland School, Lowell, Mass.
McGuire, Edward Perkins, VI, '28 (B.T.E.). With James McCreery & Co., 5 West 34th Street, New York City.
Mackay, Stewart, III, '07 (D). Assistant Professor of Textile Design, Lowell Textile Institute, Lowell, Mass.
McKay, Benedict Josephus, IV, '28 (B.T.C.). Stoughton, Mass.
McKenna, Hugh Francis, IV, '05 (D). Chicago Manager, United Indigo and Chemical Company, Ltd., 218 West Kinzie Street, Chicago, Ill.
McKinnon, Norman, VI, '29 (B.T.E.). With Sidney Blumenthal, South River, N. J.
McKinstry, James Bradley, II, '25 (D). Agent and Superintendent, H. T. Hayward Company, Franklin, Mass.
McKittrick, Raymond Wellington, VI, '28 (B.T.E.). Assistant Manager, Frank G. W. McKittrick, Lowell, Mass.
McLean, Earle Raymond, IV, '30 (B.T.C.). Industrial Fellow, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa.
MacPherson, Wallace Angus, III, '04 (D). Designer, Uxbridge Worsted Company, Uxbridge, Mass.
McQuade, Allan John, VI, '36 (B.T.E.). With The Courier-Citizen Printing Company, Lowell, Mass.
McQuaid, Barton Mathewman, IV, '32 (B.T.C.). Government Inspector of Textiles, Philadelphia Quartermaster's Depot, Philadelphia, Pa.
Macher, Henry, II, '23 (D). Secretary, Central Importing Company, Inc., of New Jersey, Passaic, N. J.
Maguire, James Joseph, II, '28 (D). Designer, Uxbridge Worsted Company, Uxbridge, Mass.
Maher, Margaret Mary, IV, '31 (B.T.C.). Laboratory Assistant, Hub Hosiery Mills, Lowell, Mass.
Mahoney, George Stephen, VI, '22 (B.T.E.). Superintendent, Franklin Cotton Mill Company, Cincinnati, Ohio.
Mailey, Howard Twisden, II, '08 (D). Manufacturing Superintendent, Worsted Division, Pacific Mills, Lawrence, Mass.
Manderbach, Harold Mills, VI, '37 (M.S.). (B.A. 1924, University of Michigan.) Captain, U. S. Army Quartermaster Depot, Philadelphia, Pa.
Manning, Frederick David, IV, '10 (D). Budget Director, American Type Founders Company, Elizabeth, N. J.
Marinel, Walter Newton, I, '01 (D). Engineer and Auto Mechanic, Morris Brothers, North Chelmsford, Mass.
Mark, Aris Sawa, VI, '22 (B.T.E.). Sales Department, Franklin Manufacturing Company, Inc., 40 Worth Street, New York City.
Markarian, Haig, IV, '33 (B.T.C.). With Farwell Bleachery, Lawrence, Mass.
Markarian, Moushy, IV, '36 (B.T.C.). Chemist, Arnold Print Works, North Adams, Mass.
Marshall, Chester Stanley, II, '22 (D). Supervisor, Skenandoa Rayon Corporation, Utica, N. Y.
Martin, Harry Warren, IV, '11 (D). With Hood Rubber Company, Inc., Watertown, Mass.
Mason, Archibald Lee, VI, '09 (D). Concord Road, Billerica, Mass.
Mason, Philip Edwin, IV, '26 (B.T.C.). Chemist, Watson Park Company, Ballardvale, Mass.
Mather, Harold Thomas, VI, '13 (D). Inspector, Associated Factory Mutual Fire Insurance Companies, Boston, Mass.
Mathieu, Alfred Jules, II, '20 (D). Salesman, Dyeing and Combing, French Worsted Company, Woonsocket, R. I.
Matthews, Elmer Clark, II, '17 (D). Secretary and General Manager, Thermo Mills, Inc., Hudson, N. Y.

Matthews, Raymond Lewis, IV, '34 (B.T.C.). Overseer of Dyeing, Crompton Shenandoah Company, Waynesboro, Va.

Matthews, Robert Jackson, VI, '29 (B.T.E.). Salesman, Pacific Mills, 261 Fifth Avenue, New York City.

Mauersberger, Herbert Richard Carl, III, '18 (D). Technical Editor, Rayon Publishing Corporation, 303 Fifth Avenue, New York City.

Mazer, Samuel, IV, '26 (B.T.C.). In business, Dyer and Converter of Yarns, S. Mazer & Co., Allston, Mass.

Meadows, William Ransom, I, '04 (D). Cotton Registrar, Chicago Board of Trade, Chicago, Ill.

Meehan John Joseph, IV, '32 (B.T.C.). With Warwick Print Works, Bound Brook, N. J.

Meek, Lotta, IIIb, '07 (C). See Parker, Mrs. Herbert L.

Meeker, Samuel, IV, '27 (B.T.C.). Chemist, Aridye Corporation, Fairlawn, N. J.

Megas, Charles, IV, '37 (B.T.C.). Assistant Overseer and Chemist, Millbrook Woolen Mills, Inc., Yantic, Conn.

Meinelt, Herbert Eugene, IV, '32 (B.T.C.). With Lorraine Manufacturing Company, Pawtucket, R. I.

Merchant, Edith Clara, IIIb, '00 (C). Supervisor of Art, Public Schools, Lowell, Mass.

Merrill, Allan Blanchard, IV, '11 (D). Technical Superintendent, B. F. Goodrich Company, Akron, Ohio.

Merrill, Gilbert Roscoe, VI, '19 (B.T.E.). Professor of Textiles; in charge of Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.

Merrill, John Leslie, VI, '27 (B.T.E.). Instructor in Weaving, Lowell Textile Institute, Lowell, Mass.

Meyers, Chester William, IV, '27 (B.T.C.). Associate Dyer, Massachusetts Knitting Mills, Jamaica Plain, Mass.

Midwood, Arnold Joseph, IV, '05 (D), Salesman, E. I. du Pont de Nemours & Co., 140 Federal Street, Boston, Mass.

Miller, Joshua, VI, '24 (B.T.E.). Material Engineer, Naval Aircraft Factory, Navy Yard, Philadelphia, Pa.

Minge, Jackson Chadwick, I, '01 (C).

Mirsky, Leon Robert, II, '19 (D). 230 West 97th Street, New York City.

Mitchell, Charles Alvah, II, '24 (D). Assistant Superintendent of Woolen Department, Roxbury Carpet Company, Saxonville, Mass.

Moller, Ernest Arthur, II, '22 (D). Eastern Representative, Petroleum Sales Division, The Goodyear Tire & Rubber Co., Inc., Boston, Mass.

Molloy, Francis Henry, II, '16 (D). Salesman, F. C. Huyck & Sons, New York City.

Moody, Leon Eugene, IV, '34 (B.T.C.). Superintendent, U. S. Finishing Company, Sterling, Conn.

Moore, Edward Francis, II, '25 (D). With Ball Band Plant, U. S. Rubber Products, Inc., Mishawaka, Ind.

Moore, Everett Byron, I, '05 (D). With Bridgeport Fabrics, Inc., Bridgeport, Conn.

Moore, Karl Remick, IV, '11 (D). Chief Chemist, Alexander Smith, Yonkers, N. Y.

Moore, William Joseph, IV, '21 (B.T.C.). Colorist, Pacific Mills, Lawrence, Mass.

Moorhouse, William Roy, IV, '01 (D). Resident Manager, National Aniline and Chemical Company, Inc., 150 Causeway Street, Boston, Mass.

Moran, Edward Francis, IV, '32 (B.T.C.). Chemist, Lawrence Manufacturing Company, Lowell, Mass.

Moreno, Emilio Gomez, Jr., VI, '36 (B.T.E.). Draftsman, Whitin Machine Works, Whitinsville, Mass.

Morrill, Howard Andrew, VI, '16 (D).

Morris, Merrill George, IV, '16 (B.T.C.). Chemist, National Aniline & Chemical Co., 357 West Erie Street, Chicago, Ill.

Morrison, Haven Asa, IV, '25 (B.T.C.). Wool Technician, Ciba Company, Inc., New York City.

Morrison, Roland Charles, IV, '34 (B.T.C.). With U. S. Finishing Company, Providence, R. I.

Morse, Judson Pickering, II, '33 (D). Wool Salesman, Lindenfelser & Co., 263 Summer Street, Boston, Mass.

Mullaney, John Francis, VI, '20 (B.T.E.). Higgins & Mullaney, 323 Chalifoux Building, Lowell, Mass.

Mullen, Arthur Thomas, II, '09 (D). Industrial Manager, Commonwealth of Massachusetts, West Concord, Mass.

Munroe, Sydney Philip, I, '12 (D). With Wellington Sears Company, New York City.

Murphy, John Joseph, IV, '33 (B.T.C.). Assistant Chemist, Bates Manufacturing Company, Lewiston, Me.

Murray, James, IV, '13 (D). Chief Chemist, Martin Cantine Company, Saugerties, N.Y.

Murray, James Andrew, II, '10 (D). Analyst, Massachusetts Unemployment Compensation Commission, Boston, Mass.

Myers, Walter Flemings, VI, '29 (B.T.E.). Chelmsford, Mass.

Najar, G. George, IV, '03 (D). Overseer of Dyeing, Monument Mills, Housatonic, Mass.

Nary, James Anthony, II, '22 (D). Manager, United States Testing Company, Inc., Chicago, Ill.

Natsios, Basil Andrew, IV, '37 (B.T.C.). 98 Lewis Street, Lowell, Mass.

Nelson, Roy Clayton, II, '21 (C). Resident Manager, Assabet Mills, Maynard, Mass.

Nelson, Russell Sprague, VI, '22 (B.T.E.). With Draper Corporation, Hopedale, Mass.

Nerney, Francis Xavier, IV, '37 (B.T.C.). Colorist, National Aniline & Chemical Co., Buffalo, N. Y.

Neugroschl, Sigmond Israel, I, '21 (D).

Newall, J. Douglas, IV, '09 (D). Agent in charge of Operations, Boston Duck Company and Bondsville Bleachery & Dye Works, Bondsville, Mass.

Newcomb, Guy Houghton, IV, '06 (C). Manager, Philadelphia Dye Sales, E. I. du Pont de Nemours & Co., 1616 Walnut Street, Philadelphia, Pa.

Neyman, Julius Ellis, IV, '15 (B.T.D.). Furniture Dealer, Neyman Furniture Company, 193-199 Middlesex Street, Lowell, Mass.

Nichols, Raymond Elmore, VI, '10 (D). Draftsman, H. E. Fletcher Company, West Chelmsford, Mass.

Niven, Robert Scott, VI, '12 (D). Draftsman, General Electric Company, Lynn, Mass.

Nostrand, Mrs. William L. (Conklin, Jennie Grace), IIIb, '05 (C).

O'Brien, Philip Francis, II, '15 (D). (B.S. New York University, M.A. Fordham University.) Chairman, Textile Department, Textile High School, New York City.

O'Connell, Clarence Edward, IV, '11 (D). Dyer, National Aniline and Chemical Company, Buffalo, N. Y.

O'Connor, Lawrence Dennis, VI, '17 (D). With Beggs & Cobb Winchester, Mass.

O'Donnell, John Delaney, I, '04 (C).

O'Hara, William Francis, IV, '04 (C).

Olson, Carl Oscar, II, '24 (D). Real Estate Salesman, Richard F. Jones, Jr., Hartford, Conn.

Orlauski, Anthony, IV, '32 (B.T.C.). 696 Washington Street, Haverhill, Mass.

Orr, Andrew Stewart, IV, '22 (B.T.C.). Manager, Storey & Co., Brockton, Mass.

Osborne, George Gordon, VI, '28 (B.T.E.). (M. Sc. 1932, North Carolina State College.) With Wellington, Sears Company, Boston, Mass.

Othote, Louis Joseph, I, '23 (D). Salesman J. W. Valentine Co., Inc., 40 Worth Street, New York City.

Palais, Samuel, IV, '18 (B.T.C.). With Worcester Knitting Company, Worcester, Mass.

Parechanian, James Humphrey, IV, '35 (B.T.C.). Development, United States Rubber Company, at the Naugatuck Chemical Company, Naugatuck, Conn.

Parigian, Harold Hrant, IV, '28 (B.T.C.). Chemist, Archer Rubber Company, Milford, Mass.

Parker, Everett Nichols, I, '05 (D). President, Parker Spool and Bobbin Company, 27-53 Middle Street, Lewiston, Maine.

Parker, Mrs. Herbert L. (Meek, Lotta L.), IIIb, '07 (C). 4 Brookside Circle, Auburn, Maine.

Parker, Hubert Frederic, VI, '20 (B.T.E.). Engineer, New York & Pennsylvania Co. and Castanea Paper Company, Lock Haven, Pa.

Parker, John George, Jr., IV, '31 (B.T.C.). With George C. Moore Company, Westerly, R. I.

Parkin, Robert Wilson, VI, '27 (B.T.E.). Superintendent, Limerick Yarn Mills, Limerick, Me.

Parkis, William Lawton, I, '09 (D).

Parsons, Charles Sumner, VI, '27 (B.T.E.). With Hathaway Manufacturing Company, New Bedford, Mass.

Peabody, Roger Merrill, II, '16 (D). Superintendent, Watson-Park Company, 261 Franklin Street, Boston, Mass.

Pearlstein, Maxwell, III, '28 (D). Proprietor, Abbotsford Pharmacy, Roxbury, Mass.
Pearson, Alfred Henry, IV, '11 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.
Peary, John Ervin, III, '31 (D). Assistant Designer, Wilton Woolen Company, Wilton, Me.
Pease, Chester Chapin, I, '09 (D). Agent, Columbian Mills (Otis Company), Greenville, N. H.
Peck, Carroll Wilmot, IV, '13 (D). Vice-President, George Mann & Co., Inc., Providence, R. I.
Penney, Cabot William, III, '33 (D). Assistant Designer, Wyandotte Worsted Company, Pittsfield, Mass.
Pensel, George Robert, IV, '13 (B.T.D.). Vice-President, Ritter Chemical Company, Inc., Amsterdam, N. Y.
Perkins, John Edward, III, '00 (D). 24 Abbott Street, Pittsfield, Mass.
Perkins, J. Dean, III, '08 (D). Superintendent, Arms Textile Manufacturing Company, Manchester, N. H.
Perlman, Samuel, IV, '17 (B.T.C.). 61 Main Avenue, Passaic, N. J.
Perlmuter, Barney Harold, IV, '23 (B.T.C.). Manufacturer, Mallon Mattress Company, Boston, Mass.
Pero, Richard Omer, II, '31 (D). Intervale Mills, Inc., Quinebaug, Conn.
Peterson, Eric Arthur, IV, '31 (B.T.C.). Chemist, Wyandotte Worsted Company, Waterville, Me.
Petty, George Edward, I, '03 (C). Real Estate, 211 Ashe Street, Greensboro, N. C.
Phaneuf, Maurice Philippe, III, '20 (D). Accountant, Librarie St. Michel, Inc., Boston, Mass.
Phelan, Bernard Michael, IV, '29 (B.T.C.). Assistant Dyer, National Aniline and Chemical Co., 351 Abbott Road, Buffalo, N. Y.
Phelan, Leonard John, IV, '35 (B.T.C.). Textile Colorist, National Aniline & Chemical Co., Buffalo, N. Y.
Pierce, George Whitwell, IV, '25 (B.T.C.). Superintendent of Dyeing and Finishing, Kramer Hosiery Company, Nazareth, Pa., and Queen City Textile Corporation, Allentown, Pa.
Piligian, Hiag Nishan, IV, '32 (B.T.C.). Assistant Dyer, Bay State Thread Works, Springfield, Mass.
Pillsbury, Ray Charles, I, '13 (D). Superintendent, Cheney Brothers, Manchester, Conn.
Pizzuto, Joseph James, Jr., IV, '33 (B.T.C.). 65 Circular Avenue, Pittsfield, Mass.
Plaisted, Webster E., II, '18 (D). Superintendent of Woolens, Pacific Mills, (Worsted Division), Lawrence, Mass.
Plovnick, Max David, IV, '35 (B.T.C.). Textile Chemist, Southern Asbestos Company, Charlotte, N. C.
Poremba, Leo Louis, IV, '35 (B.T.C.). 4 Oak Street, Lowell, Mass.
Potter, Carl Howard, I, '09 (D). Direct Mill Agent and Broker, 100 Worth Street, New York City.
Pottinger, James Gilbert, II, '12 (D). Director, Reliance Manufacturing Company, 212 West Monroe Street, Chicago, Ill.
Powers, Walter Wellington, IV, '20 (B.T.C.). Sales Division, Fiberloid Corporation, Indian Orchard, Mass.
Pradel, Alois Joseph, III, '00 (D). Designer, Killingly Worsted Company, Danielson, Conn.
Pradel, Mrs. Alois J. (Walker, Anna G.), IIIb, '03 (C). 78 Broad Street, Danielson, Conn.
Precourt, Joseph Octave, VI, '21 (B.T.E.). Sales Agent, January & Wood Co., 222 West Adams Street, Chicago, Ill.
Prescott, Walker Flanders, IV, '09 (D). Manager, Prescott & Co., Reg'd, 774 Saint Paul Street, West, Montreal, Can.
Preston, Harold Lawrence, VI, '30 (B.T.E.). Sales Engineer, Chester C. Stewart Company, 8 Beacon St., Boston, Mass.
Putnam, George Ives, IV, '16 (B.T.D.).
Putnam, Leverett Nelson, IV, '10 (D). Overseer of Dyeing, Pacific Mills (Worsted Division), Lawrence, Mass.
Putnam, Philip Clayton, IV, '13 (D). Overseer of Dyeing, Apponaug Company, Apponaug, R. I.

Quigley, Gerald Francis, IV, '31 (B.T.C.). With Franklin Rayon Corporation, Providence, R. I.
Quinlan, William Harold, VI, '20 (B.T.E.). 171 Highland Street, Worcester, Mass.

Radford, Garland, II, '20 (D). Vice-President, Oriental Textile Mills, Houston, Texas.

Ramsdell, Theodore Ellis, I, '02 (D). President, Monument Mills, Housatonic, Mass.

Rawlinson, Richard William, VI, '31 (B.T.E.). Designer, Nashua Manufacturing Company, Nashua, N. H.

Ray, Lloyd Sanford, IV, '30 (B.T.C.). Chemist and Electro Plater, Excelsior Hardware Company, Stamford, Conn.

Raymond, Charles Abel, IV, '07 (D). Silviculturist, Essex, Mass.

Recher, Theodore, VI, '33 (B.T.E.). Sales Manager, R. Recher, Providence, R. I.

Redding, Leslie Capron, II, '26 (D). Assistant Designer, Dunn Worsted Mills, Woonsocket, R. I.

Redmond, James Reynolds, IV, '36 (B.T.C.). With Ciba Co., Inc., New York City.

Reed, Harold Ernest, VI, '37 (B.T.E.). Technical Writer and Editor, International Correspondence Schools, Scranton, Pa.

Reed, Norman Bagnell, I, '10 (D). Manager, Lowell Hosiery Mills, Inc., Lowell, Mass.

Regan, Paul William, IV, '37 (B.T.C.). 103 Sherman Street, Lowell, Mass.

Reinhold, Kurt Herman, VI, '28 (B.T.E.). Statistician, Russell Manufacturing Company, Middletown, Conn.

Reynolds, Fred Bartlett, II, '08 (D). Purchasing Agent, M. T. Stevens & Sons Company, North Andover, Mass.

Reynolds, Isabel Halliday, III, '03 (C). Clerk, Pacific Mills Print Works, Lawrence, Mass.

Reynolds, Raymond, II, '24 (D). Supervisor, DuPont Rayon Company, Buffalo, N. Y.

Rice, Josiah Alfred, Jr., III, '20 (D). Merchandise Manager, Marshall Field & Co., 200 Madison Avenue, New York City.

Rice, Kenneth Earl, VI, '29 (B.T.E.). With Sidney Blumenthal & Co., Shelton, Conn.

Rich, Edward, IV, '15 (B.T.D.). Manager, Jackson Caldwell Company, East Boston, Mass.

Rich, Everett Blaine, III, '11 (D). "Onacove," Sewall Road, Wolfeboro, N. H.

Rich, Milton Scott, II, '22 (D). Assistant Purchasing Agent, Harvard University, Cambridge, Mass.

Richardson, George Oliver, IV, '16 (B.T.D.). Manager, Special Products Division, National Aniline and Chemical Company, Inc., 40 Rector Street, New York City.

Richardson, Richardson Perry, I, '13 (D). Salesman, H. F. Livermore Company, Boston, Mass.

Riggs, Homer Chase, VI, '17 (B.T.E.). President, Riggs & Lombard, Inc., Lowell, Mass.

Ripley, George Keyes, II, '17 (D). Textile Manufacturer, Troy Blanket Mills, Troy, N. H.

Rivers, William Anthony, II, '24 (D).

Roarke, John James, IV, '36 (B.T.C.). Dyestuff Chemist, Geigy Company, 88 Broad Street, Boston, Mass.

Robbins, Lucy Wiley, VI, '37 (B.T.E.). Graduate Student, Lowell Textile Institute, Lowell, Mass.

Robbins, Walter Archibald, VI, '30 (B.T.E.). Assistant to Plant Engineer, Columbia Mills, Inc., Minetto, N. Y.

Roberson, Pat Howell, I, '05 (C). Vice-President, Union State Bank, Pell City, Ala.

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Robillard, Gerald Adelbert, IV, '33 (B.T.C.). Textile Research Chemist, Regent Knitting Mills, Ltd., St. Jerome, Que.

Robinson, Ernest Warren, IV, '08 (D). Manager, Line Division, The Shakespeare Company, Kalamazoo, Mich.

Robinson, Russell, VI, '21 (B.T.E.). Overseer, Warwick Mills, West Warwick, R. I.

Robinson, William Albert, II, '25 (D). Author and Explorer, 16 Chauncy Street, Cambridge, Mass.

Robinson, William Carleton, III, '03 (C). With Durand Shoe Company, Auburn, Maine.

Robson, Frederick William Charles, IV, '10 (D).

Rodalvicz, Francis Rudolph, IV, '28 (B.T.C.). Assistant Chemist, American Woolen Company, Wood Worsted Mills, Lawrence, Mass.

Royal, Louis Merry, VI, '21 (B.T.E.). Instructor of Science and Mathematics, Pawtucket Senior High School, Pawtucket, R. I.

Rundlett, Arnold Dearborn, VI, '12 (D). Superintendent, Joseph Noone's Sons Company, Peterborough, N. H.

Runnells, Harold Nelson, IV, '25 (B.T.C.). 32 Franklin Street, Concord, N. H.
Russell, Harold William, VI, '32 (B.T.E.). In Charge Testing and Research Laboratory, Goodall Worsted Company, Sanford, Me.
Russell, John William, IV, '20 (B.T.C.). Chemist, American Lanolin Corporation, and E. Frank Lewis Mill, Lawrence, Mass.
Russell, William Samuel, Jr., VI, '28 (B.T.E.). Division Head, Textile Department, Keasbey & Mattison Co., Ambler, Pa.
Ryan, David Louis, II, '27 (D). Salesman, Duplan Silk Corporation, 18 West Chelten Avenue, Philadelphia, Pa.
Ryan, Lawrence Francis, IV, '23 (B.T.C.). Chemist, E. I. du Pont de Nemours & Co., Inc., Technical Laboratory, Deepwater, N. J.
Ryan, Millard Kenneth Thomas, Jr., II, '24 (D). 320 Vernon Road, Germantown, Philadelphia, Pa.
Ryberg, Bertil August, IV, '29 (B.T.C.), '36 (M.S.). Research Chemist, American Association of Textile Chemists and Colorists, Lowell Textile Institute, Lowell, Mass.

Sadler, Thomas Sheridan, II, '30 (D). With Southern Asbestos Company, Charlotte, N. C.
Sampson, Clifford William, IV, '28 (B.T.C.). New England Manager, Emery Industries, Inc., of Cincinnati, Ohio, 821 Chelmsford Street, Lowell, Mass.
Sanborn, Frank Morrison, VI, '19 (B.T.E.). With Winnsboro Mills, Winnsboro, S. C.
Sanborn, Ralph Lyford, VI, '16 (B.T.E.). Assistant Purchasing Agent, Firestone Cotton Mills, Inc., Gastonia, N. C.
Sandlund, Carl Seth, VI, '25 (B.T.E.). Research, Propper-McCallum Hosiery Company, Northampton, Mass.
Sargent, Robert Edward, IV, '25 (B.T.C.). Chemist, Tubize Chatillon Corporation, 2 Park Avenue, New York City.
Sargent, Walter Ambrose, I, '22 (D). Instructor, Textile Shop Practice, Board of Education, Passaic, N. J.
Saunders, Harold Fairbairn, IV, '09 (D). 301 West 8th St., Coffeville, Kans.
Savard, Aime Albert, Jr., IV, '33 (B.T.C.). Assistant Chemist, United States Finishing Company, Norwich, Conn.
Savery, James Bryan, II, '23 (D). Assistant Sales Manager, Phillips Petroleum Company, Windsor, Conn.
Sawyer, Henry Severance, VI, '32 (B.T.E.). With Sawyer, Regan Company, Dalton, Mass.
Sawyer, Richard Morey, VI, '27 (B.T.E.). (M.S., 1929, Massachusetts Institute of Technology.) Cost Engineer, Firestone Cotton Mills, Inc., Gastonia, N. C.
Scanlon, Andrew Augustine, IV, '26 (B.T.C.).
Schaetzel, Andre Paul, IV, '21 (B.T.C.). Chief Chemist, Associated Dyeing & Printing Corporation, Paterson, N. J.
Schneiderman, Jacob, III, '27 (D). Golf Professional, 48 Wolcott St., Dorchester, Mass.
Schoelzel, Herman Walter, IV, '35 (B.T.C.). With Ayer Mill, Lawrence, Mass.
Schreiter, Ehrich Ernest Max, VI, '26 (B.T.E.). Assistant Industrial Sales Manager, Tide Water Oil Company, Boston, Mass.
Schwarz, Herman Louis, IV, '22 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., 61 Van Dam Street, New York City.
Scott, Gordon Maxwell, IV, '20 (B.T.C.).
Shaber, Hyman Jesse, VI, '17 (B.T.E.). (M.B.A., 1922, Harvard University.) Shoe Buyer and Merchandiser, J. S. Raub Shoe Stores, Wilkesbarre, Pa.
Shah, Kantilal Hiralal, VI, '36 (B.T.E.). Student, Massachusetts Institute of Technology, Cambridge, Mass.
Shah, Shantilal Hiralal, IV, '34 (B.T.C.). Bombay, India.
Shain, Joseph, IV, '35 (B.T.C.). 41 Stanwood Street, Roxbury, Mass.
Shanahan, James Edward, II, '22 (D). Manager, Hygeia Ice & Coal Company, Amsterdam, N. Y.
Shananquet, Mrs. Lee (Woodies, Ida A.), IIIb, '00 (C).
Shann, William Edwin, II, '35 (D).
Shapiro, Simon, VI, '34 (B.T.C.). Testing and Research Department, Gotham Silk Hosiery Company, Wharton, N. J.
Shea, Francis James, II, '12 (D). 98 Pine Street, Florence, Mass.
Shea, John Francis, IV, '28 (B.T.C.). Demonstrator, Buffalo Electro-Chemical Co., Inc., 207 A Street, Boston, Mass.
Shedd, Jackson Ambrose, III, '28 (D). Superintendent, S. Stroock & Co., Inc., Newburgh, N. Y.

Shelton, Charles Leopold, VI, '29 (B.T.E.). Service Engineer, C. F. Houghton, Philadelphia, Pa.

Shenker, Nahman, III, '25 (D).

Sidebottom, Leon William, IV, '11 (D). Assistant Director of Research, Boston Blacking & Chemical Company, East Cambridge, Mass.

Sjostrom, Carl Gustof Verner, Jr., III, '17 (D). Production Manager, Glastonbury Knitting Mills, Addison, Conn.

Slamin, Alfred Francis, I, '26 (D). Representative, Benjamin Franklin Paint Company, Philadelphia, Pa.

Sleeper, Robert Reid, IV, '00 (D). Textile Chemist, Calco Chemical Company, Bound Brook, N. J.

Smith, Allen Batterman, I, '26 (D). Turner Halsey Company, 40 Worth Street, New York City.

Smith, Doane White, II, '10 (D). 15 Oakland Street, Natick, Mass.

Smith, Frank Kenfield, II, '24 (D). Technician, Grout's, Ltd., St. Catharines, Ont.

Smith, Harold, IV, '34 (B.T.C.). Chemist, Blackstone Plush Mills, Inc., Clinton, Mass.

Smith, Herbert Jeffers, VI, '22 (B.T.E.). Sales Representative, U. S. Ring Travelers Company, Providence, R. I.

Smith, Ralston Fox, I, '04 (C). Sales Manager, W. H. Warner & Co., 1708 Union Trust Building, Cleveland, Ohio.

Smith, Roger Dennis, II, '27 (D). Assistant Superintendent, M. T. Stevens & Sons Co. (Pentucket Mills), Haverhill, Mass.

Smith, Theophilus Gilman, Jr., IV, '10 (D). Farming, Groton, Mass.

Snelling, Fred Newman, II, '03 (D). With the American Railway Express Company, Haverhill, Mass.

Sokolsky, Henry, VI, '17 (B.T.E.). Time Study Supervisor, B. F. Sturtevant Company, Hyde Park, Mass.

Somers, Benjamin, II, '25 (D). 128 Pleasant Street, Brookline, Mass.

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Spanos, James Peter, IV, '37 (B.T.C.). With Farr Alpaca Company, Holyoke, Mass.

Spiegel, Edward, II, '03 (C).

Stacey, Alfred Charles, IV, '30 (B.T.C.). Chemist, Shoe Lace Company, Lawrence, Mass.

Standish, John Carver, IV, '11 (D). Superintendent, Albany Felt Company, Albany, N. Y.

Stanley, John Prince, Jr., IV, '29 (B.T.C.). Chemist and Overseer of Bleaching, Certified Laboratories, Inc., Austin, Texas.

Stass, John George, II, '27 (D). Textile Analyst, Better Fabrics Testing Bureau, 101 West 31st Street, New York City.

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Steele, Everette Vernon, IV, '24 (B.T.C.). Purchasing Agent, Rohm & Haas Co., Inc., Philadelphia, Pa.

Stein, William Joseph, VI, '35 (B.T.E.). Textile Broker, Harry Strauss & Co., 66 Leonard Street, New York City.

Stephens, Arnold George, I, '29 (D). With Wm. S. Haynes, 108 Massachusetts Avenue, Boston, Mass.

Stevens, Raymond Russell, IV, '19 (B.T.C.). Chief Chemist, The Felters Company, Inc., Millbury, Mass.

Stevens, William Edwin, I, '34 (D). With B. B. & R. Knight Corporation, (Royal Mill), River Point, R. I.

Stevenson, Murray Reid, III, '03 (C).

Stewart, Alexander, VI, '31 (B.T.E.). Inspector of Textiles, Quartermaster's Depot, Chicago, Ill.

Stewart, Arthur Andrew, II, '00 (D). Professor of Textiles; in charge of Finishing Department, Lowell Textile Institute, Lowell, Mass.

Stewart, John Weeden, IV, '30 (B.T.C.). Technical Demonstrator, General Dyestuff Corporation, 435 Hudson Street, New York City.

Stewart, Walter Lawrence, III, '03 (D).

Stiegler, Harold Winfred, IV, '18 (B.T.C.). (M.S., 1922, Ph.D., 1924, Northwestern University.) Head of Textile Division, American Cyanamid Company, Stamford, Conn.

Stohn, Alexander Charles, III, '06 (C). General Superintendent, Carl Stohn, Inc., Hyde Park, Mass.

Stolzberg, Howard Nathaniel, IV, '35 (B.T.C.). Chemist, Suffolk Knitting Company, Lowell, Mass.
Stone, Ira Aaron, IV, '09 (D). Vice-President, Royal Manufacturing Company, Charlotte, N. C.
Storer, Francis Everett, II, '07 (D). Meredith, N. H.
Storey, Alvin Briggs, VI, '28 (B.T.E.). Assistant Textile Superintendent, Celanese Corporation of America, Cumberland, Md.
Stott, John Smith, III, '28 (D). With Newmarket Manufacturing Company, Lowell, Mass.
Stronach, Irving Nichols, IV, '10 (D). Superintendent, Hampton Company, Easthampton, Mass.
Strout, Kenneth Edward, III, '28 (D). Designer, American Mills Company, New Haven, Conn.
Sturtevant, Albert William, IV, '17 (D). Mechanic, Lowell Motor Sales, Inc., Lowell, Mass.
Sturtevant, Fred William, IV, '26 (B.T.C.). Chemist, Naugatuck Chemical Division, United States Rubber Products, Inc., Naugatuck, Conn.
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Sutcliffe, Henry Mundell, II, '25 (D).
Sutton, Leslie Emans, I, '17 (D). Manager, Anniston Cordage Company, Anniston, Ala.
Swain, Harry LeRoy, Jr. I, '26 (D). With Firestone Tire & Rubber Co., Akron, Ohio.
Swan, Guy Carleton, II, '06 (D). Chemist, U. S. Department of Agriculture, 201 Varick Street, New York City.
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Syme, James Francis, II, '00 (D). Industrial Management, 27 Linnaean Street, Cambridge, Mass.
Symmes, Dean Whiting, IV, '22 (B.T.C.). Salesman and Demonstrator, National Aniline and Chemical Company, 150 Causeway Street, Boston, Mass.

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Tang, Hsiung-Yuan, I, '30 (D). Assistant Manager, Sung Sing Cotton Mill, No. 3, Vice President & Works Manager, Yih Hsing Woolen & Worsted Mills, Wusih, Kiangsu, China.
Tarpey, Thomas Joseph, IV, '27 (B.T.C.). 23 Fremont Street, Somerville, Mass.
Tarshis, Elias Aaron, IV, '28 (B.T.C.).
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Thompson, Arthur Robert, Jr., IV, '22 (B.T.C.). Salesman, Ciba Company, Inc. Charlotte, N. C.
Thompson, Everett Leander, I, '05 (D). 53 Morse Avenue, Brockton, Mass.
Thompson, George Robert, IV, '35 (B.T.C.). Chemist, United States Finishing Company, Providence, R. I.
Thompson, Henry James, IV, '00 (D). 15 Greenleaf Street, Malden, Mass.

Todd, Walter Ernest, III, '23 (D). Resident Agent, Metropolitan Life Insurance Company, Uxbridge, Mass.

Toepler, Carl, IV, '22 (B.T.C.). Supervisor Permanent Finish Department, Bellman Brook Bleachery Company, Fairview, N. J.

Toher, Francis Luke, IV, '32 (B.T.C.). Assistant Dyer, Leban-Hope Mills (Hope Knitting Division), Pawtucket, R. I.

Topjian, Leon, IV, '30 (B.T.C.). 416 Massachusetts Avenue, Boston, Mass.

Toshach, Reginald Alexander, II, '11 (D). Proprietor, Toshach's Mill Remnants, Haverhill, Mass.

Toupin, Stephane Frederick, VI, '24 (B.T.E.). Plant Engineer, Regent Knitting Mills, Ltd., St. Jerome, Quebec.

True, William Clifford, II, '22 (D). Night Superintendent, Ludlow Manufacturing & Sales Co., Allentown, Pa.

Turcotte, David Henry, IV, '33 (B.T.C.). 523 Fletcher Street, Lowell, Mass.

Tyler, Bernard James, IV, '36 (B.T.C.). Textile Testing, United States Testing Company, Hoboken, N. J.

Tyler, Lauriston Whitcombe, II, '16 (D). Manager, W. T. Grant Company, Portsmouth, N. H.

Valentine, Burnet, VI, '23 (B.T.E.). Department Manager, Pepperell Manufacturing Company, 40 Worth Street, New York City.

Valentine, Preston Sumner, IV, '36 (B.T.C.). With Nye-Waite Kilmarnock Corporation, Auburn, N. Y.

Vaniotis, Socrates Vasilios, IV, '37 (B.T.C.). 13 Willie Street, Lowell, Mass.

Varnum, Arthur Clayton, II, '06 (D). Superintendent, Pioneer Mill, Pittsfield, Me.

Villa, Luis Jorge, IV, '25 (B.T.C.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.

Villa, William Horace, VI, '24 (B.T.E.). Technical Director, Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.

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Walker, Anna Gertrude, IIIb, '03 (C). See Pradel, Mrs. Alois J.

Walker, Raymond Scott, II, '23 (D). Engineer, Ernst & Ernst, Boston, Mass.

Walker, Samuel J., IV, '32 (B.T.C.). Analyst, National Association of Dyers and Cleaners, Silver Springs, Md.

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Wang, Chen, IV, '23 (B.T.C.).

Wang, Cho, VI, '23 (B.T.E.).

Wang, Tung Chuan, VI, '23 (B.T.E.).

Wang, Yun-Cheng, VI, '31 (B.T.E.). Assistant Manager, Sung Sing Cotton Mill No. 1, Shanghai, China.

Wang, Yung Chi, II, '21 (D).

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Warren, Philip Hamilton, II, '05 (D). Superintendent, Hopeville Manufacturing Company, Worcester, Mass.

Washburn, John Milton, Jr., IV, '21 (B.T.C.). Salesman, Colgate-Palmolive-Peet Company, Boston, Mass.

Watson, William, III, '11 (D). Real Estate, Frank E. & Wm. Watson, 50-54 Merrimack Street, Haverhill, Mass.

Webber, Arthur Hammond, IV, '01 (D). Colorist, Irving Tanning Company, Peabody, Mass.

Webster, Joseph Albert, VI, '23 (B.T.E.). General Manager, Aberfoyle, Inc., Norfolk, Va.

Weinstein, Edward Joseph, VI, '25 (B.T.E.). Harrison Hardware Company, Harrison, N. Y.

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Wetherbee, Francis Putney, I, '28 (D). Plant Manager, Flint River Cotton Mills, Albany, Ga.
Wheaton, Walter Francis, VI, '23 (B.T.E.). Stationer, Walter F. Wheaton, White Plains, N. Y.
Wheelock, Stanley Herbert, II, '05 (D). President and Treasurer, Stanley Woolen Company, Uxbridge, Mass.
Whitcomb, Roscoe Myron, IV, '10 (D). Pharmacist, R. M. Whitcomb, Ashland, N. H.
White, Royal Philip, II, '04 (D). Treasurer and General Manager, Leominster Mills, Inc., Leominster, Mass.
Whitehill, Warren Hall, IV, '12 (D). Groton, Mass.
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Wightman, William Henry, IV, '06 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.
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Wilkie, Robert Campbell, VI, '34 (B.T.E.). Research Engineering, Pacific Mills, Lawrence, Mass.
Wilkinson, Herbert William, Jr., IV, '37 (B.T.C.). With Sturbridge Printing & Finishing Co., Fiskdale, Mass.
Williams, Albert William, III, '32 (D).
Williamson, Douglas Franklin, I, '22 (D). Assistant to General Superintendent, Allred Plant, Granite Falls Manufacturing Company, Granite Falls, N. C.
Wilman, Rodney Bernhardt, II, '25 (D). Superintendent, New England Fibre Blanket Company, Worcester, Mass.
Wilson, Raymond Bachman, II, '36 (D). With Lorraine Mfg., Co., Pawtucket, R. I.
Wing, Charles True, III, '02 (D). Paymaster, Merrimack Woolen Corporation, Dracut, Mass.
Wingate, Edward Lawrence, Jr., VI, '28 (B.T.E.). Assistant to Superintendent, Russell Manufacturing Company, Middletown, Conn.
Wingate, William Henry, IV, '08 (D). Superintendent, Hodges Finishing Company, Dedham, Mass.
Wise, Paul Tower, II, '01 (D). President, Chelsea Fibre Mills, 1155 Manhattan Avenue, Brooklyn, N. Y.
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Woo, Tsunkwei, VI, '19 (B.T.E.).
Wood, Ernest Hadley, S. B., IV, '11 (D).
Wood, James Carleton, IV, '09 (D). Sales Representative, R. T. Vanderbilt Company, New York City.
Wood, Lawrence Burnham, IV, '17 (B.T.C.). Chemist, Pacific Print Works, Lawrence, Mass.
Woodbury, Kenneth Leroy, VI, '28 (B.T.E.). With Sidney Blumenthal Company, Shelton, Conn.
Woodcock, Eugene Close, II, '07 (D). Manager, Jute Yarn Department, Ensign Bickford Company, Simsbury, Conn.
Woodhead, Joseph Arthur, VI, '23 (B.T.E.). With Colgate-Palmolive-Peet Company, Jersey City, N. J.
Woodies, Ida Alberta, IIIb, '00 (C). See Shananquet, Mrs. Lee.
Woodman, Harry Lincoin, I, '02 (C). 422 Pine Street, Lowell, Mass.
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Wu, Tsung-Chieh, VI, '25 (B.T.E.).
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Yavner, Harry, II, '12 (D). Merchant, Mayo's Hardware Company, Jamaica Plain, Mass.

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Ziock, LeRoy, II, '25 (D). President, Ziock Industries, Inc., Rockford, Ill.

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SERIES 41, NO. 4 May, 1938

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

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1938-1939

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Moody Street and Colonial Avenue

DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

Publication of this Document Approved by the Commission on Administration and Finance.
2500. 6-'38. Order 4245.

James C. Buzzell Evening Instructor in Electricity	100 Park Avenue, East.
Glen Bowden Caswell Evening Instructor in Machine Shop.	32 Hampshire Street.
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Inez L. Keller Evening Instructor in Art.	22 Chestnut Street, Winchester.
Ivar O. Moberg Evening Instructor in Weaving.	64 Thirteenth Street.
Margaret L. Smith Evening Instructor in Art.	62 Florence Avenue.
John L. Dolan Evening Instructor in Mathematics.	173 Pleasant Street.
Harold R. Anderson Evening Instructor in Worsted Yarns.	R.F.D., Westford.
George P. Silva Evening Instructor in Diesel Engines.	48 Humphrey Street.
Francis L. Dacey Evening Instructor in Geometry.	4 Horne Street.
Chester Brown Evening Instructor in Weaving.	726 School Street.
William J. Chenard Evening Instructor in Weaving.	656 Gorham Street.

LOWELL EVENING TEXTILE SCHOOL

By Act of the Legislature of 1928, the name of the Lowell Textile School was changed to Lowell Textile Institute, and the evening classes are organized and are to be hereafter operated as a department of the Institute to be known as the Lowell Evening Textile School.

CALENDAR.

1938.	
September 22, Thursday	Registration.
September 29, Thursday	Registration.
October 3, Monday	Opening of evening school.
November 11, Friday	Armistice Day—Holiday.
November 24, Thursday November 25, Friday	Thanksgiving recess. No classes.
December 20, Tuesday	End of first term.
1939.	
January 5, Thursday	Opening of second term.
March 10, Friday	Closing of evening school.
April 6, Thursday	Graduation.

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card,

which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in

which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjejcts which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

111. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made.

Two evenings each week.

COTTON.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cotton desired and securing delivery at a known price.

OPENING AND PICKING.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

CARDING.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

COMBING.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doublings necessary

to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

DRAWING.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

ROVING.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjejcts of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

RING SPINNING.—A study of the various types of yarns gives the student an appreciation of the necessary characteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studies in detail. Important machine parts, such as rings, builders, guides and travelers, their adjustment and care, form an important part of this subject. Yarn faults and defects are shown and their causes explained.

SPOOLING AND WINDING.—The discussions under this head cover the treatment of single yarns, in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

TWISTING.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

114. Cotton Organization—1 Year.

This course, offered only to those who have completed the work in Carding and Spinning, is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

211. Woolen Yarns—1 Year.

Instruction consists of lectures on technology of wool fiber (for detailed description see Course 212) and woolen yarn manufacture. This covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emul-

sions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Reworked fiber (shoddy) is covered in detail from rag sorting to finished staple.

Three evenings each week.

217. Wool and Top Making—1 Year.

Instruction consists of lectures in technology of wool fibers, worsted carding and combing, and mechanism and calculations.

TECHNOLOGY OF WOOL FIBRES—*one evening each week.*

RAW MATERIALS.—The study of raw materials which enter into the manufacture of woolen or worsted yarns or hardened felts, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel hair, cut staple rayon, etc. In connection with these are considered shoddy, noils, and extracts.

WOOL SORTING.—Familiarity with the various grades and kinds of wool is obtained by lectures. The various characteristics and properties are explained, as are also trade terms, such as Fine, ½-blood, ⅜-blood, 56s, 36s, B super, delaine, braid, etc. Over 1,500 samples of wool and other fibers gathered from all the countries of the world are catalogued and are available for inspection and study. Wool shrinkages are studied as are also spinning qualities. A complete collection of literature pertaining to sheep, wool, etc., is available for outside reading or study.

WOOL SCOURING.—The objects of scouring or degreasing and the methods employed are explained. This involves the consideration of soaps and chemicals used in scouring and degreasing, also the waste products and their utilization. A sorted lot of grease wool is scoured by machines that are made similar in operation to regular commercial wool scouring machines. At the same time the use of driers, their operation and regulation, is taken up.

CARBONIZING.—The methods of carbonizing wool, noils, burr waste, rags, etc. are studied. If time permits, a commercial quantity of stock is carbonized on the regulation carbonizing machines in the wool laboratory.

WORSTED CARDING AND COMBING—*one evening each week.*

CARDING.—The different types of worsted cards are studied in detail, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application, grinding, setting, etc.

COMBING.—This branch takes up the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and Noble comb is studied by lectures. Two Noble combs are available for inspection and study.

MECHANISM AND CALCULATIONS—*one evening each week.*

This subject gives the principles of the various mechanisms used in wool manufacturing machines. Among the topics dealt with are—equations, surface speed, R. P. M., drivers, drivens, draft and production calculations, stop motions, combing layouts, levers, logarithms, top testing, calculations, etc.

218. Worsted Yarns—1 Year.

Instruction is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

DRAWING AND SPINNING.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the

functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule or frame. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

219. Air Conditioning—2 Years.

The subjects covered in this course include the following; fundamental laws, principles and definitions; physical properties of the atmosphere; explanation of words and terms used, such as—matter, energy, heat, heat energy, temperature, ice, water, vapor, gas, steam, thermometers, hygrometers, hydrometers, barometers, pressure, gage pressure, absolute pressure, absolute temperature, laws of gases, heat units, vapor pressure, dew point, evaporation, condensation, precipitation, relative and absolute humidity; sensible heat, latent heat, specific heat, total heat of air, effective temperature, comfort zones, air movement, ventilation; movement of heat and air, infiltration, conduction, solar heat, air breakage; heat from human beings; lights, machinery and processes; humidification and dehumidification, heating and cooling, air filtration, air washing; refrigeration and refrigerants, cooling by water, ice, typical air-conditioning equipment, typical control equipment, thermostats, humidostats, wet and dry bulb type; use of charts and tables, costs, etc.

Students are required to hand in complete details for producing prescribed conditions of temperature and humidity in some building in or near Lowell, Mass., before completing the course.

One evening each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruc-

tion. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quilting, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313.—Decorative Art—3 Years.

The *first year* work consists of charcoal drawing from casts, models, and group arrangements of still life.

Two evenings each week.

During the *second year* instruction is given in color harmony—a study of true color and variety of effects obtainable.

Two evenings each week.

In the *third year* the student chooses one of the following options:

1. Design—Motifs suitable for fabric, wall paper, linoleum, etc.

2. Costume Illustration—Drawing from the clothed figure.
3. Oil Painting—A study of values and color using oil as a medium.

Two evenings each week.

314. Advertising Design—2 Years.

Lettering.—During the *first year* the student is taught to master the dawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

Show Card Design.—The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms. Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate

from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

THEORETICAL CHEMISTRY.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulae valence, periodic law, etc.

NON-METALLIC ELEMENTS.—Study of their occurrence, properties, preparation, chemical compounds, etc.

METALLIC ELEMENTS.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is a follows:—

TECHNOLOGY OF VEGETABLE FIBERS.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

TECHNOLOGY OF ANIMAL FIBERS.—Wool, mohair, silk. Chemial and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

TECHNOLOGY OF ARTIFICIAL FIBERS.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

OPERATIONS PRELIMINARY TO DYEING.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing, silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the

emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

WATER AND ITS APPLICATION IN THE TEXTILE INDUSTRY.—Impurities present, methods of detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

MORDANTS AND OTHER CHEMICAL COMPOUNDS USED IN TEXTILE COLORING, AND CLASSIFIED AS DYESTUFFS.—Theory of mordants, their chemical properties and application, aluminium mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

NATURAL ORGANIC COLORING MATTERS.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

MINERAL COLORING MATTERS.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

ARTIFICIAL COLORING MATTERS.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

LANGUAGE DEPARTMENT.

510. English Composition—2 Years.

REMEDIAL ENGLISH AND RHETORIC—*First year.* Parts I and II. In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles.

The following subjects are studied: The eight parts of speech—characteristics and use of each; the kinds and the structure of sentences; punctuation; the building up of the paragraph; the principles of composition; description, exposition, narration, argumentation, and letter writing; study of difficult words; and selections from various authors to be read for general interest and for the purposes of illustration.

10 assignments in each part with an examination at the end of each part.

One evening each week.

PROBLEMS IN THE INTERPRETATION AND THE APPRECIATION OF LITERATURE—*Second year.*—This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling,

inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

Two evenings per week.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, and in Mechanics and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

Two evenings each week.

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horsepower, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires home problem work and the study of a text book.

Two evenings each week.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

Two evenings each week.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory undertanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

Two evenings each week.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

Two evenings each week.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. A considerable amount of home study and preparation is required. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation. testing and control of direct current machinery.

Two evenings each week.

624. Alternating Current Electricity—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work.

Two evenings each week.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated. A text book is required.

Two evenings each week.

626 Mill Illumination—1 Year.

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

Two evenings each week.

628. Selling and Advertising—1 Year.

This course covers the basis principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

Two evenings each week.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears, gearing, cams and similar topics. Home problem work and the study of a text book are required.

Two evenings each week.

631. Plane Geometry—2 Years.

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

Two evenings each week.

632. Diesel Engines—1 Year.

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

Two evenings each week.

Accounting Classes

(Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered.

The drying and tentering machines and extractors employed are taken up at this point.

GIGGING, NAPPING AND STEAMING.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

BRUSHING, SHEARING AND PRESSING.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1938

Certificates awarded as follows, April 6, 1938:

Cotton Yarns—2 Years.

Phelicien Alfred Archambault, Lowell
Otis Milton Humphrey, Lowell
Samuel Royce McMaster, Lowell

Knitting—1 Year.

John Burton Austin, Reading
Max Cooperstein, Malden
William Joseph Dawson, Lowell

Woolen Yarns—1 Year

William Edward Andrews, N. Andover
Hollis Goodenow Barlow, Maynard
Francis William Bradley, Lawrence
Jack Gilbert, Methuen
Edwin Charles Hughes, Lawrence
Joseph Peter Kort, Lawrence
John Leopold Marselis, Lawrence
Myles Edwin Nuttall, N. Billerica
John Harvey Painter, Methuen
John Stanley Pudlow, Lowell
Millage Stennett Rawnsley, Lowell
Charles Henry Redman, Lowell
Emil Ristaino, Lawrence
Lawrence Ervin Thompson, Haverhill
Joseph Martin Wasiuk, Lowell

Worsted Yarns—2 Years.

George Frederick Cohen, Lawrence
John Orin Fleming, Lawrence
Norman Matthew Fleming, Jr, Lawrence
Arthur Joseph Frank, Lowell
Albert Edwin Greenwood, Lawrence
John Michael Gustartis, Methuen
Wesley David Harper, N. Chelmsford
Peter Herberchuk, Salem, N. H.
Thomas Anthony Knox, Lawrence
Seth Robinson Lambert, Methuen
Paul Albert Lanni, N. Andover
Donald Joseph LeRiche, Lowell
Arnold Chester McQuaide, Lowell
Albert Picking, Westford
Norman Alderson Rayner, Methuen
Lawrence Talantzy, Graniteville
Arthur Norris Thompson, Chelmsford
Clifford Herman Varnum, E. Chelmsford
Raymond Francis Vennard, N. Chelmsf'd
Stanley John Wajda, Lowell
John Norman Ward, N. Chelmsford
Bryce Henry Wilson, Methuen

Wool and Top Making—1 Year

William Rimmington Addy, Dorchester
James Leo Batts, Jr., Methuen
William Beaudette, N. Chelmsford
George Cosman, Cambridge
Robert Holland Cossaboom, N. Chelmsf'd
Francis David Cryan, Lowell
Francis Stanley Dzioba, Lawrence
Joseph James Fratoni, Salem
George Warren Joseph Furey, Lowell
William Joseph Golubisky, N. Chelmsf'd
Donald Gordon, Lowell
Walter Grandalski, Lawrence
Charles Parker Honeyman, N. Chelmsf'd
F. Gardner Hopkins, Jamaica Plain
John Frederick Kinch, N. Chelmsford
Thomas Joseph Lattinville, Jr. Lawrence
Edward Paul McCluskey, Lowell
Edward Francis McLenna, Graniteville
Nathaniel Williams Matthews, Jr. Lowell
Benjamin Morris Mikulis, Jr. N. Chelmsford
James Joseph Missett, Methuen
Clarence Warren Mooar, Andover
Everett Varney Olsen, N. Chelmsford
Roland Douglas Phinney, Lowell
James Taylor Poor, N. Andover
Norman Eric Roberts, Lawrence
Albert Austin Sanford, Lowell
Eldon Stowell, Lowell
Walter Tuniewicz, Lowell

Air Conditioning—2 Years.

Lawrence Clarence Bellegarde, Lowell
Joseph Frederic Burtt, Lowell
Albert Allen Denio, Lowell
Henry Herbert Dowd, Lowell
Lucien Johnston Harmon, Lowell
Richard Mangan Harrington, Lowell
Walter Joseph Jurczak, Lawrence
Donald Joseph LeRiche, Lowell
Harold Norman Logan, Lowell
Charles Joseph Murray, Lowell
Whitman Pearson, Lowell

Cotton Design—3 Years.

Clifford Robert Holgate, Lowell
Patrick Joseph Keegan, Lowell
Walter Capen Wright, Littleton Common

Woolen and Worsted Design—3 Years.

Philip Schubert Benoit, Methuen
Albert Binns, Methuen
Arthur Binns, Methuen
Herve Joseph Blanchette, Lawrence
John Clarke, Methuen
Arthur Robert Clinton, Lawrence
Thomas Vincent Curley, W. Medway
Frederick Darlington, Methuen
Henry Francis Drenth, Methuen
Francis Anthony Dubrawski, Medway
Daniel Earl Huntley, Medway
John Joseph Janowski, Lawrence
Rene Lionel Lacharite, Lawrence
Matthew Adam Novak, Lawrence
Charles Joseph Plummer, Lawrence
Samuel Joseph Smelter, Lawrence
Horace Nathaniel Stevens, Jr. N. Andover
Alden Robert Walls, Andover

Advertising Design—2 Years.

Norman Gerald Allaby, Lowell
Paul Emile Bolduc, Lowell
Doris Rita Breton, Lowell
Louis Frederick Gagniere, Lowell
George Jardine, Lowell
Maurice Origene Mercier, Lowell
Juliette Marie Poirier, Lowell
Anna Patricia Wrenn, Lowell

Decorative Art—3 Years.

Ruth Helene Blum, Lowell
Marie-Jeanne Roseanna Huot, Lowell
Ann Dorathea Kasinskas, Lowell
Rainhold Hugo Lake, Lowell
Irwin Herbert Laurencelle, Lowell
Mary Petrakos, Lowell
Ingrid Israella Robinson, Lowell

Cotton Weaving—1 Year.

Charles Bazdanes, Lowell
Ernest August Johnson, Nashua, N. H.
Paul Kanelas, Lowell
William Kmiec, N. Andover
Matt Korol, Manchester, N. H.
Henry Raymond Krystyniak, Lowell
Gabrielle Eugenie Lagasse, Lowell
Edward John Maslanka, Lowell
Charles James Metropolis, Lowell
George Arthur Pappas, Lowell
Emil Charles Piekos, Lowell
Mitchell Charles Stec, Lowell
Joseph Anthony Stewart, Lowell

Woolen and Worsted Weaving—1 Year.

Edward Joseph Bacher, Andover
Joseph Frank Baron, Lowell
Leo William Conlin, Lowell
Francis Joseph Dion, Lowell
Herbert Francis Donaghey, Andover
Arthur James Flanagan, N. Andover
William Peter Gaudaitis, Lawrence
Philippe Maurice Gauthier, Lowell
William Scott Glendenning, N. Andover
John Henry Hargreaves, Methuen
John Holden, Lawrence
Wilfred Craven Holroyd, Methuen
Edward Baxter Kirwin, Andover
Arthur Omer Leclair, Lowell
Rudolph Augusta Mackie, Lowell
Raymond Fabien Maille, Lowell
Frank Leo Makrecky, Maynard
Thomas James Megdanis, Lowell
Andrew John Mitzcavitch, Maynard
John Joseph Molda, Lowell
Albert Joseph Morin, Lowell
William Arthur Morin, Lawrence
Joseph Richard Mozykowski, Lowell
David Murray, Lawrence
Theodore Andrew Patenaude, Lowell
Walter Jerome Patenaude, Lowell
Wilbur Woodrow Pearson, Methuen
Walter Knot Peterson, Dracut
Adam Anthony Potsavich, Lawrence
Noe George Provencher, Lowell
Thomas Aloysius Reynolds, Lowell
Harold Richard, Lawrence
William Maxwell Thomson, Lawrence
Otho Wilton Tompkins, Lawrence
Roland Joseph Toupin, Lowell
Joseph Joseph Walsh, Jr., Maynard
William Charles Wasiuk, Maynard
Joseph Francis Wessells, Lowell
Donald Everett Williams, Dracut

Loom Fixing—1 Year.

Christos Anganes, Lowell
George Gordon Armstrong, Jr. Littleton
Kenneth William Bardsley, Lawrence
Joseph Calixte Boisvert, Lowell
Arthur Denis Boucher, Lowell
Andrew Joseph Brouillette, Lowell
Albert Armand Catineau, Lawrence
Hector Joseph Dalphond, Lowell
Harry Page Day, Salem
Walter Lacheta, Manchester, N. H.
Raymond Joseph Laliberte, Lawrence
Donat George Lamourex, Lowell
Wilfred Avila Lepine, Lowell
Henry John Panek, Lowell
James Pappas, Lowell
Raymond Edward Skelley, Salem
Charles Tzikopoulos, Lowell
Clifford Walton, Lawrence

Woolen and Worsted Finishing—1 Year.

Thomas Gordon Armour, Methuen
Charles Edward Bauchman, Lawrence
Chester Robert Bell, Lowell
Stanley Chwalek, Lawrence
Gordon Kenneth Crawford, Methuen
George William Daley, Haverhill
Hugh Raymond Dunn, Lowell
George Clifford Emmons, Andover
Charles John Frey, Lawrence
John Fraser Giffin, Wilton, N. H.
Bert Gilbert, Methuen
Charles Norman Gregoire, Wilton, N.H.
Frederick Richard Holt, N. Andover
Raymond Maxime Lafortune, Lowell
David Williamson Lawrie, Lawrence
Arthur Thomas Little, Methuen
Leno Mendaca, Lawrence
Thomas Bernard Murray, Lawrence
George Albert Nahill, Lawrence
John Nauiokas, Lawrence
B. Vincent Oldfield, Lawrence
Joseph John Orlando, Methuen
Leslie Packard, Methuen
Evariste Joseph Pepin, Lawrence
John Francis Sedlesky, Lowell
John Taylor, Jr. Methuen
John Henry Terris, N. Billerica
William Albert Theriault, Lawrence
Frank Thompson, N. Andover
Robert Griffin Thompson, Haverhill
Herbert Clinton Vose, Wilton, N. H.
Irving Melvin Weighill, Lawrence

Analytical Chemistry—3 Years.

Walter Samuel Bean, Jr., Lowell
Alfred Calabrese, E. Boston
John Doulames, Lowell
Weldon Maxwell Huckins, Woburn
Paul Bernard Klier, Lawrence
John Erwin Martin, Lowell
Herbert Neild, Lowell
Herve Armand Paquin, Lowell
Edward Wallace Rutyna, Lowell

Textile Chemistry and Dyeing—3 Years.

William Gray Bailey, Newton Highlands
Guido Joseph Cianci, Lawrence
Najie Elias Daher, Lawrence
William Arthur Drummond, N. Andover
George Henry Ennis, N. Billerica
Harry Ralph Johnson, Lawrence
Joseph Vincent King, Bradford
Ernest Albert Lehninger, Methuen
John Joseph Morrison, Lawrence
Donald Raymond Neil, Lowell
George Rodney Schmottlach, Lawrence
Anthony John Villani, Lawrence

Elementary Chemistry—2 Years.

Chester Burton Brown, Methuen
Richard Stearns Bunting, Methuen
Harry Chadwick, Andover
Edward Cherowbrier, Jr., Andover
Ronald Clamp, Methuen
Albert Gordon Coates, Ballardvale
Charles Frederick Connors, Woburn
Thomas Patrick Fitzgerald, Lawrence
Walter Frank Gacek, Lowell
Donald Edward Gagnon, E. Pepperell
Harvey George Gendreau, Lowell
Walter Ginsburg, Roxbury
Maryclare Rita Hayes, Lowell
James William Holden, Lowell
Gilbert Oscar Just, Methuen
Magan Samuel M. Krasnecki, N. Chelmsford
Charles Eugene Lisien, Lowell
Walter Lisien, Lowell
Grace Mary McMenimon, Lowell
Harold Clifton Malloy, Westford
Kenneth Raymond Morley, Methuen
Emanuel Naparstek, Lowell
Alberton Vinal Olsen, N. Chelmsford
Dennison Kimball Peel, Haverhill
Edward Francis Poremba, Lowell
Joseph Thomas Provissia, Lawrence
Daniel Francis Quealy, Lowell
Paul Gould Robbins, Jr., Lawrence
Wilbur Hartley Roberts, Lowell
Charles William Saalfrank, N. Andover
Russell Charles Sheehan, Lowell
John Hollywood Shinner, Methuen
Charles Joseph Stahle, Lawrence
Dore Earle Tyler, Lowell
Herbert Ernest Wieland, Lawrence
Joseph Peter Willan, Lawrence
Robert Winslow, Salem, N. H.
James Lincoln Wolfindale, Lawrence

Mechanical Drawing—3 Years.

Real Edward Bourque, Lawrence
Fernando Etienne Charest, Nashua, N.H.
Amedee Ronald Cote, Lowell
Gilles Bernard Cote, Manchester, N. H.
Paul Albert Daigle, Lawrence
Raymond Lionel Dupont, Nashua, N. H.
Paul Lucien Gauthier, Lowell
Charles Merrill Hamblett, Lowell
Robert George Hewson, Methuen

Alternating Current Electricity—2 Years.

Lawrence Francis Gauthier, Nashua, N. H
Arthur Evans Gay, Nashua, N. H.
Edward Freeland Jones, Lowell
Frank Joseph Rochette, Lowell
Charles Bernard Wilson, Methuen
Lloyd Arnold Wilson, Methuen

Direct Current Electricity—2 Years.

Clarence Everett Foster, Dracut
Thomas Joseph Harding, Lowell
Francis John Hopkins, Lowell
Alexander Joseph Kotarba, Lowell
Denis Arthur Lebel, Lowell
John Thompson McCormick, Chelmsford
Edmund Stevens McDonagh, Lowell
Raymond Thomas McDonagh, Lowell
William Asa Todd, Lawrence
Vosken Tomasian, Nashua, N. H.

Steam—1 Year.

George Gordon Armstrong, Littleton
John Edward Birchall, Lowell
Normand Robert Demers, Nashua, N.H.
Murdock Welcome Weathers, Lowell
Donald Harriman Wentworth, Lowell

Machine Shop Practice—2 Years.

Gerard Armand April, Lowell
Alfred Joseph Archambault, Lowell
Lucien Armand Arsenault, Lowell
Lloyd James Aspinall, Lowell
Alphonse Louis Bilewick, Lowell
Leon Joseph Bolduc, Lowell
Arthur Huntley Cady, Nashua, N. H.
Theodore Edward Chmura, Lawrence
Albert Eugene Dery, Lowell
George Edward Dery, Lowell
Clifford Joseph Duhamel, Methuen
Cyrill Feugill, Jr., Methuen
Arthur Fluet, Jr., Lawrence
Gerard Alphonse Fluet, Lawrence
William Francis Garrigan, Lowell
Michael John Karos, Nashua, N. H.
Alfons Bartholomew Kleponis, Lawrence
William Paul Kotarba, Lowell
Andrew John McArthur, Lowell
Louis Octave Mailhot, Lowell
Albert Joseph Masse, Lowell
Ernest Etienne Matton, Lawrence
Albert Dominique Narbonne, Lowell
Arthur Cyril Naylor, Methuen
Edmond Razza, Lawrence
Joseph Arthur Richard, Lowell
Leonard Slicer, N. Andover
Edward Richard Thibault, Lowell
Frederick Smith Whittaker, N. Andover

Diesel Engines—1 Year.

Russell Angis Beauchemin, Lowell
Alexander Belida, Graniteville
Guido Carlos Belli, Lowell
Leslie Walton Bellwood, Lowell
Philip Bibeault, Lowell
John Ernest Bourdelais, Lawrence
Raymond Irving Buchanan, Chelmsford
William Leo Burke, Lawrence
Joseph Albert Camden, Lowell
Rodolphe Joseph Coutu, Lowell
Roger Cedric Currier, Lowell
George Henry Dorval, Lowell
Philip Elias George, Lowell
Andrew Elzear Hamilton, N. Chelmsford
William Hughes, Lowell
Stanley Konieczny, Lowell
James Linatsas, Nashua, N. H.
William Garrett MacLean, Lowell
Bernard Alphonse Mullen, Lowell
William Joseph Murphy, Lowell
James Aloysius O'Gorman, Lawrence
Daniel Thomas O'Leary, Lawrence
Terence Patrick O'Rourke, Lowell
Peter Sechovich, Forge Village
Henry Frederic Silver, Lowell
Lawrence Talantzy, Graniteville
Robert Foster Wignall, Lowell
William James Winn, Lowell

Mathematics—2 Years.

Humphrey Joseph Coffey, Lowell
John Andrus Dean, W. Chelmsford
Lila Helen Downing, Lowell
Julia Myrtle Gentz, Lowell
Robert Mellor Green, Lowell
Walter Joseph Grondalski, Lowell
Betty John Kosartes, Lowell
Evenor Sophie Kosartes, Lowell
Mary Sophie Kosartes, Lowell
James Joseph McCartin, Lowell
Andrew James McDougall, Jr. Methuen
Peter Nicholas Mitsakos, Lowell
Christos Theodore Sarris, Lowell

Selling and Advertising—1 Year.

Don Albert Bakewell, Lowell
Kenneth Woodrow Brousseau, N. Andover
Angus Campbell, Lowell
Marguerite Mary Carland, Lowell
Joseph Francis Carney, Lowell
John Thomas Cleghorn, Chelmsford
James Bagshaw Coffey, Lowell
James Francis Cuerden, Lowell
Morris Davis, Lawrence
Theodore Efthymios Economou, Lowell
Elizabeth Rita Fenlon, Lowell
Paul Francis Gennell, Lowell
Alice Rita Hamill, Lowell
Harold Gilbert Heifetz, Lawrence
Alfred John Jodes, Lawrence
Walter Joseph Jurczak, Lawrence
Mary Kalemaras, Lowell
Henry Kaplan, Lawrence
Morris Kay, Lawrence
Edward George Krasnecky, N. Chelmsf'd
John George Kuzlotsky, Lawrence
David Lemkin, Lowell
James Russell McKeon, Lowell
Myrtle Elizabeth MacMillan, Lowell
Louis Francis Shadid Mansur, Lowell
Vincent Frank Miller, N. Andover
William Russell Moher, Nashua, N. H.
Andrew John Moynahan, Lowell
Anna Katharine Mullen, Lowell
Chester Howard Niles, Lowell
Donald Ernest Peaslee, Lowell
Lionel Alfred Pinet, Nashua, N. H.
Edwin John Riley, Lowell
Gerald Francis Riley, Lowell
George Francis Silva, Lowell
Edward Milton Simon, Lawrence
Stanley Szopa, Lowell
Peter William Tamulonis, Nashua, N.H.
Norman Harold Thrope, Lowell
John Raymond Trevors, Lowell
Alexander Vervaert, Lowell
Howard Daniel Weymouth, Lawrence

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BULLETIN

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LOWELL, MASS.

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2200—9-'38. Order 4963.

A STUDY OF THE RELATION BETWEEN THE NUMBER OF TESTS AND THE MEAN BREAKING STRENGTH AND VARIABILITY OF A TWO-PLY WORSTED YARN

This paper is a resume, prepared by Herbert J. Ball, Professor of Textile Engineering, of a thesis performed by Captain H. M. Manderbach, 1937, as a partial requirement for the degree of Master of Science in Textile Engineering.

The purpose of the thesis was to study the change in the breaking strength of a two-ply worsted yarn, as the number of tests was increased, with a view to determining the minimum number of such tests necessary to obtain a reasonably precise estimate of the mean breaking strength of the yarn and its variability.

The material consisted of one bobbin of a 2/34s and one bobbin of a 2/28s worsted yarn. Both yarns were of similar characteristics, and were unbleached and undyed. Both bobbins were of filling wind.

Single strand breaking strength tests on each yarn were made in successive groups of 5, 10, 20, 40, 80, 160, 320, and 640 after adequate exposure in the standard atmosphere of the testing laboratory. The tests were made with a hydraulically-driven, Schopper, pendulum type machine, having a capacity of 500 grams. The initial distance between jaws was 25 cm. and the speed of the pulling jaw was twelve inches per minute. The strand of yarn was clamped in the jaws under an initial tension of 10.5 grams, and care was taken to avoid any loss of twist. All tests were discarded in which the break occurred at a point less than one inch from either jaw.

For each group of tests there was computed the following measures; the mean, the standard deviation, the standard error of the mean, the coefficient of variation, and the standard error of the coefficient of variation. The results of the tests and computations are given in Table I.

To compare like measures in each group Table II has been constructed. It is assumed that the mean and the coefficient of variation of the 640-test group represent the most reliable measures of these two properties of the yarn, respectively. The difference between each mean and that of the 640-test group is tabulated in column (2). The standard error of this difference is given in column (3). The significance ratio, column (4), is obtained by dividing the value in column (2) by that in column (3). In like manner columns (5), (6), and (7) have been prepared using the coefficient of variation of the 640-test group as a base. It is considered that the difference between two measures is significant where the significance ratio is three or greater.

Discussion of Results from 2/34s Yarn

The 5-test group gave the highest mean, the lowest standard deviation, and the lowest coefficient of variation, results which were quite different from those of any other group. Inspection of the original data in all of the groups showed the reason for this. Sequences of five values were found scattered throughout the entire data which gave results similar in character to the 5-test group, but whose measures differed materially from those of the larger group of which they are a part. It was obvious that the probability was low that any random 5-test group would give results reasonably representative of the breaking strength of the yarn and its variability.

While the 10-test group did give a mean closely in agreement with that of the 640-test group, its standard deviation and its coefficient of variation were the highest of all. This group was also subject to conditions similar to those indicated for the 5-test group and was deemed to be too small to be reliable. The results obtained for the 20-test group lead to a similar conclusion.

Accepting the standard error of the mean of the 640-test group as being reliable, the standard error of the mean of the other groups has been computed

and is shown in the table below contrasted with the actual standard error of the mean.

Test group	5	10	20	40	80	160	320
Actual standard error	10.81	14.53	6.92	6.24	4.38	2.96	2.33
Computed standard error	17.20	12.16	8.60	6.08	4.30	3.04	2.15

Beginning with the 40-test group and as the number of tests increases, it will be noted that the standard error of the mean as actually determined compared favorably with that based upon the 640-test group. Furthermore, the standard deviation is nearly constant and difference of the means and of the coefficients of variation are not significant. Examination of these groups leads to the conclusion that the 80-test group was the smallest which gave estimates of the mean breaking strength and of the variability of this particular yarn most closely in agreement with those shown by the 640-test group.

Discussion of Results from 2/28s Yarn

The 5, 10 and 20-test groups gave results similar to those which characterized the corresponding groups in the other yarn, and which for like reasons were therefore deemed too small to give a reliable measure of the breaking strength. Beginning with the 80-test group it was observed that the mean showed a continuous decrease in value, and that the standard deviation and the coefficient of variation increased steadily. It was therefore apparent that there was a continually changing set of conditions in the yarn which did not become stabilized even in the two largest groups. Consequently none of this data was considered acceptable for the purpose of the thesis and no further conclusions were drawn. It is recorded, however, as an illustration of a variability that may occur in a yarn and be of so great an extent that a stable condition may not be indicated even after twelve hundred and seventy-five tests.

TABLE I

2/34s Worsted Yarn

NO. OF TESTS	MEAN (grams)	STD. DEV. (grams)	STD. ERROR OF THE MEAN (grams)	COEFFICIENT OF VARIATION (%)	STD. ERROR OF THE COEFFICIENT OF VARIATION (%)
5	314.80	21.61	10.81	6.9	2.44
10	295.40	43.58	14.53	14.7	3.54
20	265.55	30.20	6.92	11.4	1.87
40	283.32	38.97	6.24	13.8	1.60
80	292.70	39.03	4.38	13.3	1.08
160	303.50	37.44	2.96	12.3	0.70
320	297.35	41.70	2.33	14.0	0.56
640	296.15	38.59	1.52	13.0	0.38

Grand mean (of 1275 tests) = 296.34 grams

2/28s Worsted Yarn

NO. OF TESTS	MEAN (grams)	STD. DEV. (grams)	STD. ERROR OF THE MEAN (grams)	COEFFICIENT OF VARIATION (%)	STD. ERROR OF THE COEFFICIENT OF VARIATION (%)
5	416.50	18.28	9.14	4.4	1.55
10	372.05	47.96	15.99	12.9	3.09
20	349.50	38.17	8.75	10.9	1.78
40	363.00	37.93	6.07	10.4	1.19
80	379.90	37.76	4.23	9.9	0.80
160	378.85	42.42	3.36	11.2	0.63
320	368.30	44.13	2.46	12.0	0.48
640	364.30	46.38	1.83	12.7	0.36

Grand mean (of 1275 tests) = 368.10 grams

TABLE II

2/34s Worsted Yarn

(1) NO. OF TESTS	(2) DIFFERENCE OF MEANS (grams)	(3) STD. ERROR OF THE DIFFERENCE OF MEANS (grams)	(4) SIGNIFICANCE RATIO	(5) DIFFERENCE OF COEFFICIENTS OF VARIATION (%)	STD. ERROR OF THE DIFFERENCE OF COEFFICIENTS OF VARIATION (%)	(7) SIGNIFICANCE RATIO
5	18.65	10.92	1.71	6.1	2.47	2.47
10	0.75	14.60	0.05	1.7	3.56	0.48
20	30.60	7.08	4.21	1.6	1.91	0.84
40	12.83	6.42	2.00	0.8	1.64	0.49
80	3.45	4.64	0.74	0.3	1.14	0.26
160	7.35	3.33	2.21	0.7	.80	0.87
320	1.20	2.78	0.43	1.0	.68	1.47
			2/28s Worsted Yarn			
5	52.20	9.32	5.60	8.3	1.59	5.21
10	7.75	16.04	0.48	0.2	3.11	0.06
20	14.80	8.94	1.65	1.8	1.82	0.99
40	0.70	6.34	0.11	2.3	1.24	1.85
80	15.60	4.61	3.38	2.8	.88	3.18
160	14.55	3.82	3.81	1.5	.73	2.05
320	4.00	3.07	1.30	0.7	.60	1.17

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LOWELL TEXTILE INSTITUTE
Louis Pasteur Hall

LOUIS PASTEUR HALL

During the past ten years the expanding curriculum of the Chemistry and Textile Coloring Department and the increasing number of students in both the day and evening classes made it more and more evident that additional facilities must be provided. It was a source of much gratification to the trustees and to the faculty who have felt the need of additional floor space and had worked out detail plans for its use, to learn that the State Budget for the Year 1937 as passed included an item of $150,000 for this building.

Following preliminary lay-outs for various laboratories, lecture and recitation rooms the architects, Ashton and Huntress of Lawrence, Massachusetts, prepared plans and specifications which were submitted for public competitive bidding. The lowest bid for the general construction was submitted by Louis Marion & Sons of Lowell, Massachusetts, and the work was started December 23, 1937. The building of three stories was designed to rest on the single-story building, known as the Colonial Avenue Building, built in 1910, thus making a four-story building on the side of the quadrangle facing the Merrimack River.

In addition to three large laboratories for Organic Chemistry, Quantitative Analysis, and Experimental Dyeing, there are small laboratories for special research work, and larger laboratories for Physical, Colloidal, and Electro Chemistry with those for Textile Testing and Photomicrographic Analysis. To these are added the usual lecture room and recitation rooms besides a convenient library and reading room.

The construction of the building proceeded, except for some weather interference, with customary speed and was ready to be accepted and dedicated on September 19, 1938. At a meeting of the board of trustees held in the early part of 1938 it was voted on a motion of Mr. John E. Regan that when the building is dedicated it shall be called the Louis Pasteur Hall. Previous to the Dedicatory Program a luncheon was held in Southwick Hall to which the trustees invited the president, faculty, and guests, including the State Comptroller, George E. Murphy; Honorable Dewey G. Archambault, Mayor of Lowell; and the speaker of the day, Rev. John J. McGarry, D.C.L., of Roslindale, Massachusetts. Then followed a special meeting of the trustees at which the building committee reported through its chairman, Mr. Philip L. Scannell, that the building was completed and ready for acceptance. The other members of this committee, who have had charge of the construction, are John H. Corcoran, William F. Corliss, Albert J. Malley, John E. Regan, James H. Riley, and Charles C. Schloss.

From the trustees' room and adjoining rooms and corridors of Southwick Hall a procession was formed by the Marshal, Professor A. Edwin Wells, and led by the President followed by the trustees, invited guests, faculty, instructing staff, and students by classes in the order of graduate students, seniors, juniors, sophomores, and freshmen. Accompanied by music furnished by the Amphion Orchestra it proceeded to the new experimental dyeing laboratory on the top floor of Louis Pasteur Hall where the dedication was held. As the procession entered the Hall it was greeted by an audience of friends of the Institute.

PROGRAM OF DEDICATION

LOUIS PASTEUR HALL

Address of Welcome and Presentation of Key
Philip L. Scannell, S.B., Chairman of Trustees and of Building Committee.

Acceptance of Key
Charles H. Eames, S.B., President of Lowell Textile Institute.

Receipt of the Key
Louis A. Olney, Sc.D., Head of the Chemistry and Textile Coloring Department.

Music by Amphion Orchestra

Greetings from the City of Lowell
Hon. Dewey G. Archambault, Mayor.

ADDRESS OF DEDICATION — *Life of Louis Pasteur*
Rev. John J. McGarry, D.C.L.

Dr. McGarry's address was as follows:

"Massachusetts is still on the march. This new and spacious building is a proof, if proof be needed, that, in spite of turmoil abroad and difficult economic conditions at home, Massachusetts is determined to advance with calm confidence in the future. For it has been the policy of this state for a hundred years to promote industry by fostering scientific education. And they are shortsighted indeed and woefully ignorant of the very plain lessons of history who would condemn state expenditures for the furtherance of scientific development of our industries.

"Against this latter spirit Louis Pasteur, after whom this splendid chemistry building is named, protested with all the vehemence of his ardent nature. During the second empire, millions were being spent by the government for mere luxury and ostentation; but the scientist was forced to carry on his experiments in damp cellars, in garrets, freezing in the winter and insufferably hot in the summer, in a cubbyhole under the stairs or in other unsuitable and unhealthy places. The result was that France lagged far behind other nations in the development of natural resources. Pasteur wrote to the emperor asking for a suitable laboratory. The emperor agreed; but credit for the proposed construction was denied. Then Pasteur wrote to the official newspaper an article bristling with facts and so forceful in its expressions that the editors, in horror, refused to accept it.

First Battle Won

"But the first skirmish of a long battle was won. At least the ministry was forced to admit the importance of science to the state and to promise to make adequate provision for scientific studies. To Pasteur we should all be grateful for his immortal answer to the shortsighted, penny-wise legislators and industrialists who seem not to realize that no nation can hope to hold its own industrially or commercially unless its scientists are afforded opportunities at least equal to those enjoyed by men of science in other lands.

"The sincerity and fearlessness of Pasteur's utterances show a side of the man's character usually overlooked by those who know him only as a scientist. Yet his researches and his revolutionary scientific discoveries might even yet be embalmed in forgotten books or the subjects of barren debate and speculation were it not that Pasteur, the son of a soldier of Napoleon and himself a soldier in the revolution of 1848, fought with unflinching courage and tenacity to force a cynical scientific world to accept what he had proven to be the truth.

"It is plain, however, that the trustees of this world-famous institute were impelled to give the name of Pasteur to this splendid new building chiefly because he was a teacher and a chemist. If it seems a far cry from the little town of Dole, where Pasteur was born, to the banks of the Merrimack, from the life-span of a man who was born well over a hundred years ago and died the very year the articles of incorporation of this Institute were authorized by the state legislature, we must remember that the man of genius and the benefactor of humanity is not circumscribed by any artificial limits of time or place. He belongs to all time and to every place. His memory is a part of the heritage of all mankind and his example an inspiration to all generations.

Wanted to Be Teacher

"To be a teacher was the ambition of Pasteur's life. His reverence for his own teachers is touching in the extreme. Even after he had obtained recognition and encomiums from learned society and his fame had spread all over the world he would never address a former professor but as "my dear master" It was while still at the normal school in Paris awaiting an appointment that he prosecuted the studies in crystallography which brought him to the attention of many learned men. Thereafter his researches were guided by the industries of the place in which he taught or by special assignments entrusted to him by the government. At Lille, for example, where there were important brewing industries, he began the study of fermentation. He proved that the theory of Liebig which then prevailed everywhere, that the ferment is an alterable organic substance which exercises a catalytic force transforming sugar, was without scientific foundation, that fermentation is not a phenomenon of death, but a phenomenon of life. By use of this discovery he was able at a later date to rescue the almost ruined wine industry of France. He showed that if the wine were heated to sixty degrees, Centigrade, the ferments would be destroyed and the wine suffer none of the usual forms of deterioration.

Old Conflict Revived

"In spite of the irrefutable proofs offered, Pasteur's theory of fermentation was contested for many years. But his conclusions from his studies of fermentation led to a new and violent storm of controversy that was to endure for five years and to revive again and again for many years thereafter. It was the old conflict regarding spontaneous generation. Taught as an established fact by most of the ancient thinkers it was rejected by more modern experimenters only to be revived when the microscope revealed the presence of minute organisms in liquids where none had existed before. Pasteur showed that if all life in a liquid is destroyed by boiling and the container sealed to prevent the entrance of air, no organism will generate in the liquid.

"From these discussions he was called by a senator who had been appointed to make a study of the silk industry in which, the senator wrote, 'The distress is beyond anything you can imagine.' Although Pasteur had never seen a silkworm and knew nothing whatever about the industry he set himself to find the cause of the epidemic which was destroying the silkworms and causing such widsepread misery. He found two diseases, one indicated by tiny spots like grains of pepper, the other a disease called flacherie. For both of these he worked out a simple method of prevention. But scarcely had his studies of silkworm diseases been brought to an end when he was struck down by a paralytic stroke—at the early age of 46. From that time until the very end of his life he was never entirely free from pain.

"About this time we notice the beginning of a change in the attitude of the industrial and of the scientific world toward Pasteur's teachings. Brewers, wine-makers, silkworm producers and vinegar manufacturers were beginning to use his methods with great success. As early as 1867 Dr. Joseph Lister, a young surgeon at Glasgow, impressed by Pasteur's proofs of the effects of micro-organisms in the atmosphere, adopted a technique by which germs were prevented from coming in contact with open wounds. His success was no less than marvelous. It marked the beginning of a new era in surgery. Had his method been followed generally at that time the result would have been the saving of countless human beings who found that the slightest incision by the surgeon's knife was a door open to death.

"Robert Boyle, a distinguished philosopher of the 17th century, had said that he who would discover the nature of ferments and fermentation would be more capable than anyone else of explaining the nature of certain diseases. The truth of that prophecy was about to be realized. From the study of fermentation caused by microscopic organisms Pasteur has passed to the

diseases of silkworms. Now he was called upon to study anthrax or splenic fever which, at that time, was destroying from 20 to 30 per cent of the sheep and cattle in parts of France and which was known to attack human beings with fatal results. The specific germ of that disease had already been discovered and isolated. Pasteur not only showed that this germ is the cause of the disease but he also hit upon a method by which the minute organism could be weakened and then used as a vaccine.

Pasteur Challenged

"The announcement of this further development of the germ theory was received with the usual skepticism and even ridicule. Pasteur was challenged to test his theory on a large scale. He consented. Twenty-five sheep were to be vaccinated with attenuated anthrax virus. Then these and 25 others that had not been vaccinated, were to be inoculated with a virulent culture of anthrax. 'The 25 unvaccinated sheep will all perish,' wrote Pasteur, 'the 25 vaccinated ones will survive.' There were many confident, jeering prophecies of his failure. Yet the event proved the truth of his contention in every particular. A victory so spectacular could not fail to convince anyone not entirely blinded by prejudice. He was acclaimed all over the world. Learned societies vied with each other to do him honor. But there was yet work for him to do.

"One mystery constantly haunted his mind—that of hydrophobia, one of the most terrible of all diseases, the germ of which has never been discovered. The only treatment then known was cauterization within half an hour after its infliction. Pasteur was able to perfect a treatment whereby animals would be rendered immune to the disease and those affected could be cured. But, although he had made a long series of experiments with lower animals and had proven the efficacy of his method, when a young Alsation boy, Joseph Meister, was brought to him for treatment, he hesitated. The boy had been horribly bitten by a rabid dog and faced death in a terrible form. But would the cure that had been so successful with rabbits and other animals be successful with a human being? Assured by the physicians whom he consulted, Pasteur began the treatment. First a weak virus was administered, then some more powerful until an injection was made that would have been deadly to one not afflicted with the disease. The boy recovered. Others who had been bitten by rabid dogs and wolves were sent to Paris from all parts of Europe and even from America. Except is cases where there had been too long a delay the treatment resulted in a cure.

His Work Done

"This was the last of Pasteur's great discoveries. His work was done. Honors such as few human beings live to receive were showered upon him. He saw the construction of an institute for the study of contagious diseases and as a dispensary for the treatment of hydrophobia which is today the most important single center of research in the world. My visit to the Pasteur Institute I shall never forget. I had seen the tombs of Napoleon and of other great French military leaders. Their glory is measured chiefly by the number of enemies killed or maimed, lands laid waste, cities and towns destroyed. But in the small chapel under the Pasteur Institute lies the body of a man who saved incalculable sums to his countrymen and to people all over the world saved incalculable sums to his countrymen and to people all over the world, who led the way to stamping out the terrible epidemics which have afflicted humanity and saved uncounted millions of human lives. The hour was late when I arrived at the Institute and the gates were already closed. The custodian, however, readily agreed to show me the chapel where Pasteur's remains repose. The man was wearing wooden shoes; but as we reached the door of the chapel he removed his shoes before entering. Then, with a thrill of emotion, there leaped to my mind the thought of Moses at Mount Horeb when he heard the voice of the Lord saying, 'Put off the shoes from thy feet, for the place whereon thou standest is holy ground.' "

"May I, then, offer my most sincere and cordial felicitations to the trustees of the Lowell Textile Institute for their discernment in choosing so appropriate a name for this new and spacious chemistry building. They have done honor to themselves and honor to science by helping to perpetuate the memory of a man who was a great teacher and the most distinguished chemist of all time. More than that, they have set before the mental vision of professors and of students one who cannot fail to be an example and an inspiration. They have erected here a lasting witness to the courage and the vision of this grand old commonwealth and an enduring monument to 'the most perfect man who ever entered the kingdom of Science.' "

At the completion of his address Rev. Dr. McGarry presented the Lowell Textile Institute an autographed picture of Louis Pasteur framed beside an original letter of the great scientist. President Eames accepted this for the Institute and stated that a place for it would be found in the Chemistry Library.

The exercises were concluded by the reforming of the procession of the trustees, guests, faculty, instructing staff, and student body, which proceeded to Southwick Hall.

Southwick Hall

Louis Pasteur Hall

SERIES 42. NO. 3. February, 1939

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

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1939

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Publication of this Document approved by the Commission on Administration and Finance
6500. 3-'39. Order 6561.

CALENDAR

1938–1939

September 8–9, Thursday–Friday	Entrance Examinations
September 12–17, Monday–Saturday	Re-examinations
September 15, Thursday, 9.00 A.M.	Registration for Freshmen
September 19, Monday	Registration for upper-class students Classes begin for Freshmen
September 20, Tuesday	Classes begin for upper-class students
October 12, Wednesday	Columbus Day — Holiday
November 11, Friday	Armistice Day — Holiday
November 22, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 28, Monday, 9.00 A.M.	Thanksgiving recess ends
December 21, Wednesday, 4.45 P.M.	Christmas recess begins
January 4, Wednesday, 9.00 A.M.	Christmas recess ends
January 16, Monday	First term examinations begin
January 27, Friday	End of first term
January 30, Monday	Second term begins
February 22, Wednesday	Washington's Birthday — Holiday
March 31, Friday, 4.45 P.M.	Spring recess begins
April 10, Monday, 9.00 A.M.	Spring recess ends
April 19, Wednesday	Patriots' Day — Holiday
May 22, Monday	Second term examinations begin
May 30, Tuesday	Memorial Day — Holiday
June 6, Tuesday	Commencement
June 8–9, Thursday–Friday	Entrance Examinations

1939–1940

September 7–8, Thursday–Friday	Entrance Examinations
September 11–16, Monday–Saturday	Re-examinations
September 14, Thursday, 9.00 A.M.	Registration for Freshmen
September 18, Monday	Registration for upper-class students Classes begin for Freshmen
September 19, Tuesday	Classes begin for upper-class students
October 12, Thursday	Columbus Day — Holiday
November 11, Saturday	Armistice Day — Holiday
November 21, Tuesday, 4.45 P.M.	Thanksgiving recess begins
November 27, Monday, 9.00 A.M.	Thanksgiving recess ends
December 20, Wednesday, 4.45 P.M.	Christmas recess begins
January 3, Wednesday, 9.00 A.M.	Christmas recess ends
January 15, Monday	First term examinations begin
January 26, Friday	End of first term
January 29, Monday	Second term begins
February 22, Thursday	Washington's Birthday — Holiday
March 20, Wednesday, 4.45 P.M.	Spring recess begins
March 28, Thursday, 9.00 A.M.	Spring recess ends
April 19, Friday	Patriots' Day — Holiday
May 20, Monday	Second-term examniations begin
May 30,Thursday	Memorial Day — Holiday
June 4, Tuesday	Commencement
June 6–7, Thursday–Friday	Entrance Examinations

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HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The courses for those students who can attend the day classes are organized to prepare them to enter some one of the various branches of the textile industry. It is required that all such students shall have an educational background equivalent to that of a complete college preparatory course as given by a recognized high school or academy. These textile courses are either of three or four years duration and are described in detail on the following pages of this catalogue.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three story addition was placed on a single story building that was previously known as the Colonial Avenue Building which was erected in 1910.

This Hall contains on the first floor the Cotton Finishing laboratory with class rooms and offices of the Wool Department, also the Experimental Dyeing laboratory. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry and Textile Coloring Department.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will, it is hoped, be further improved to make a modern campus for baseball and other sports.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Bcard or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry, beginning September, 1940	1
	12

Elective Subjects

	Points
Chemistry	1
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

It is highly desirable that students entering before September, 1940, present a year of chemistry with laboratory.

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of thirteen points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry, beginning September, 1940	1
	10

Elective Subjects

Four may be selected from the list under Degree Courses.

It is highly desirable that students entering before September, 1940, present a year of chemistry with laboratory.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 8, 1939; Thursday, September 7, 1939; Thursday, June 6, 1940:—
- Algebra, 9 A.M. to 11 A.M.
- History, 11 A.M. to 1 P.M.
- English, 2 P.M. to 4 P.M.

Friday, June 9, 1939; Friday, September 8, 1939; Friday, June 7, 1940:—
- Plane Geometry, 9 A.M. to 11 A.M.
- German or French, 11 A.M. to 1 P.M.
- Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

Chemistry.—Applicants must show evidence of their familiarity with the rudiments of chemistry. Any course given in a secondary school organized to

present instruction by means of textbook or lecture, together with correlated laboratory work, will be considered as covering the requirements. The applicant's notebook with his original notes, including description of experiment, apparatus used, reactions, observations and deductions, must be accompanied by his instructor's certificate.

Importance will be placed upon manipulation and deductions as well as the general appearance and neatness of the notebook.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Within the last few years the possibilities for women in certain branches of the textile field have become recognized and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some who choose the Textile Engineering Course with the design option, for it offers a broad training that prepares for many lines of activity. For those who wish to specialize in decorative art and designing in their general application, special courses will be arranged as far as the facilities of the Institute will permit. Others who find themselves more interested in chemistry pursue the Chemistry and Textile Coloring Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students shall be the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course shall be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential

subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements. All courses both undergraduate and graduate are open to women.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 14, at 9.00 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 8.30 A.M. to 12.20 P.M., and from 1.25 to 4.00 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee is $250 per year. The fee for students from foreign countries is $500 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers, sufficiently capacious to contain clothing, books and tools, are provided for the use of the students.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (foreigners)	500
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee	10
(This applies to students who do not take chemistry or machine shop.)	
Books and supplies	50
(Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	

PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship throughout the course.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

The Proprietors of the Locks and Canals on the Merrimack River Scholarship at Massachusetts Institute of Technology. Several years ago the Proprietors of the Locks and Canals on the Merrimack River, a corporation owning the power rights on the Merrimack River in Lowell, gave to the Massachusetts Institute of Technology a sum of money to provide graduate scholarships to graduates from the Lowell Textile Institute who held a degree and were recommended by the trustees. Applicants must have maintained throughout their undergraduate courses a high scholastic record and must meet the requirements of the Graduate School of the Massachusetts Institute of Technology.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Section of the American Society of Dyers and Colorists hold meetings at which papers are delivered or speakers come from outside the school organization.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store. —A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purehasing from the Book Store and from certain firms in the city of Lowcll.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of tbe association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1938–39

Russell T. Fisher, '14, *President*
Philip F. O'Brien, '15, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*
A. Edwin Wells, '20, *Assistant Secretary*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Executive Committee

Roy H. Bradford, '06
Alexander Campbell, '23
James F. Dewey, '04
Parker F. Dunlap, '34
Olin D. Gay, '08
Robert F. Jessen, '36
Thomas Joy, '26
Harry W. Martin, '11
Brackett Parsons, '20
Richard W. Rawlinson, '31
Everett B. Rich, '11
Homer C. Riggs, '17
Henry S. Sawyer, '32
Dean W. Symmes, '22
J. Milton Washburn, Jr., '21

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term

(Common to all Courses)

	Hours of Exercise
Elementary Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Chemistry C–10	75	75
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–11 or C–11a	150	45
Stoichiometry C–12	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C-20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

Third Year. First Term

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	165
Cotton Yarn Manufacture F–30	135	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

Third Year. Second Term

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	225	Thesis F–34.	
Knitting F–31	105		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence. Instruction in the production and manipulation of re-worked wool is also included.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75	Physical Education	30
English E–10	45	Qualitative Analysis C–11a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		
Mechanism B–12	60		

Second Year. First Term

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

Second Year. Second Term

Fiber Preparation G–20–21	270	Textile Chemistry and Dyeing Lect. C-20.	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	60
Power Weaving D–24	120		

Third Year. First Term

Electricity B–31a	30	Textile Testing G–31	30
Knitting F–31	105	Woolen and Worsted Finishing H–30	75
Mill Engineering B–34a	30	Worsted Yarn Manufacture G–30	210
Power Weaving D–32	45		

Third Year. Second Term

Power Weaving D–32	195	Worsted Yarn Manufacture G–30	255
Woolen and Worsted Finishing H–30	75	Thesis.	

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Chemistry C–10	75
English E–10	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education	30
Qualitative Analysis C–11a	45
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Cotton Yarn Manufacture F–20a	90
Color and Dynamic Symmetry D–33	30
Physics B–23a	45
Power Weaving D–24	90
Steam Engineering B–24	30
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–20, 21	210

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20–21	90
Jacquard Design D–23	45
Physics B–23a	45
Power Weaving D–24	120
Textile Chemistry and Dyeing Lect. C-20	30
Textile Design and Cloth Construction D–20, 21	135

Third Year. First Term

Cotton Finishing H–31	75
Cotton Yarn Manufacture F-30a	60
Power Weaving D–32	60
Textile Design and Cloth Construction D–30	135
Textile Testing G–31	30
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	90

Third Year. Second Term

Cotton Finishing H–31	75
Cotton Yarn Manufacture F-30a	60
Jacquard Design D–31	75
Power Weaving D–32	105
Textile Design and Cloth Construction D–30	75
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	60
Thesis.	

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultra-microscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several elective subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45
Adv. Organic Chemistry C–22	30
English E–20	30
Mathematics B–20a	60
Physics B–23	65
Power Weaving D–24a	15
Quantitative Analysis C–23	130
Stoichiometry C–24	15
Textile Chemistry and Dyeing Lab. C–21	90
Textile Chemistry and Dyeing Lect. C–20	45

Second Year. Second Term

Advanced German E–21	45
Adv. Organic Chemistry C–22	30
English E–20	30
Physics B–23	65
Quantitative Analysis C–23	150
Stoichiometry C–24	15
Textile Chemistry and Dyeing Lab. C–21	145
Textile Chemistry and Dyeing Lect. C–20	45

Third Year. First Term

Adv. Organic Chemistry Lect. C–34	15
Adv. Textile Chemistry and Dyeing Lab. C–32	135
Adv. Textile Chemistry and Dyeing Lect. C–32	30
Economics E–30	45
Physical Chemistry C–33	45
Quantitative Analysis C–30	150
Technical German C–35	30
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	90
Adv. Textile Chemistry and Dyeing Lect. C–32	15
Economics E–30	45
Industrial Chemistry C–31	30
Organic Laboratory C–36	90
Physical Chemistry C–33	45
Quantitative Analysis C–30	105
Technical German C–35	30
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	75
Adv. Textile Chemistry and Dyeing Lect. C–44	30
Chemical Textile Testing C–43	45
Colloid Chemistry C–50	30
Industrial Chemistry C-42	30
Microscopy and Photomicroscopy C–45	60
Electives or Thesis C–52	90
Organic Laboratory C–41	75
Quantitative Analysis C–46	15
Report Writing C–47	15
Technical German C–40	30
Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30
Adv. Textile Chemistry and Dyeing Lab. C–44	120
Adv. Textile Chemistry and Dyeing Lect. C–44	15
Chemical Textile Testing C–43	45
Electives or Thesis C–52	90
Organic Laboratory C–41	105
Rayon Manufacturing C–51	30
Seminar in Business English E–40	15
Technical German C–40	30
Technology of Wool Manufacture Fibers G-40	15
Textile Literature C–48	30

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The course is planned so as to provide a foundation in those subjects which are essential to the training of an engineer, coupled with a thorough understanding of textile processes and materials. Such subjects as mathematics, physics, chemistry, drawing, mechanics and mechanism, provide for the first objective. The second is secured by a study of cotton, woolen and worsted yarn manufacturing, textile designing, weaving, knitting, dyeing, and finishing. Instruction is by means of lectures, recitations and laboratory work.

A large proportion of the student's time is spent in well equipped textile departments where he is familiarized with the machinery and processes used in the conversion of cotton and wool fibers into yarns and finished fabrics. The subjects of textile testing and microscopy acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering. Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice. Mill engineering familiarizes the student with factory design, construction, heating, lighting, humidification, fire protection, and the arrangement of machinery and buildings for most efficient production and economical power distribution.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

The Cotton and Wool Options of the Textile Engineering course have been provided for those students who may desire the breadth of technical training which this course offers but who wish to specialize in either cotton or wool manufacturing. In these optional courses the student's entire time is devoted to the study of that particular fiber which he elects. A demand from the distributing and marketing divisions of the textile industry for properly trained men has lead to the establishment of the Sales Option of the Textile Engineering course. This is patterned after the General Course but with more time devoted to such subjects as selling, advertising, marketing, foreign trade and the like. There have also been requests for a four-year degree course in which the design of textile materials should receive the greater emphasis. For this purpose the Design Option of the Textile Engineering course is offered, which, while majoring in textile design, includes other subjects that make a broader course than the one of shorter duration.

In the General, Design and Sales Options some recognition is given to those who may wish to lay more emphasis on knit fabrics. This is done by the substitution of knitting laboratory time for a portion of that assigned to weaving laboratory and is dependent on the possibility of arranging for such special cases.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Fiber Preparation G–20, 21	120	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–22	45
Machine Shop B–26	75		
Mathematics B–20	60		

SECOND YEAR. SECOND TERM

Applied Mechanics B–25	45	Mathematics B–20	60
Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Electives F–25		Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Machine Drawing B–21	75		

THIRD YEAR. FIRST TERM

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	60	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electives F–35		Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75		

THIRD YEAR. SECOND TERM

Cotton Yarn Manufacture F–30a	60	Mill Engineering B–34	90
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	90	Textile Microscopy B–41	45
Electrical Engineering B–44	75	Textile Testing B–43	60
Mill Engineering B–45	60	Thesis	75

FOURTH YEAR. SECOND TERM

Business Administration B–46	90	Knitting F–31a	30
Cotton Finishing H–31	105	Mill Engineering B–45	75
Electives B–48 or F–45		Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	180	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	90	Textile Design and Cloth Construction D–20	90
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Applied Mechanics B–25	45	Power Weaving D–24	60
Cotton Yarn Manufacture F–20a	135	Textile Chemistry and Dyeing Lect. C-20.	30
Machine Drawing B-21	45	Textile Design and Cloth Construction D–20	75
Mathematics B–20	60		
Physics B–23	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	180	Machine Shop B–26	45
Economics E–30	45	Power Weaving D–32	60
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	180	Heat Engineering B–33	90
Economics E–30	45	Mill Engineering B–34	90
Electrical Engineering B–31	75	Power Weaving D–32	45

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	105	Textile Microscopy B–41	45
Electrical Engineering B–44	75	Textile Testing B–43	60
Mill Engineering B–45	30	Thesis	90

Fourth Year. Second Term

Business Administration B-46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Fiber Preparation G–20, 21	225	Mathematics B–20	60
Machine Drawing B–21	90	Physics B–23	75
Machine Shop B–26	45	Textile Chemistry and Dyeing Lecture C–20	30

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B-21	45	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

Third Year. Second Term

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Electrical Engineering B–44	75	Textile Microscopy B–41	45
Mill Engineering B–45	30	Textile Testing B–43	60
Textile Design and Cloth Construction D–21	75	Thesis	120

Fourth Year. Second Term

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

SECOND YEAR. SECOND TERM

Cotton Yarn Manufacture F–20a	60	Power Weaving D–24	105
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60	Textile Design and Cloth Construction D–20, 21	105
Physics B–23	75		

THIRD YEAR. FIRST TERM

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	120		

THIRD YEAR. SECOND TERM

Color and Dynamic Symmetry D–33	45	Textile Design and Cloth Construction D–30	75
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	135		

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Microscopy B–41	45
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Textile Design and Cloth Construction D-41	75	Textile Testing B-43	60
Textile Marketing B–42	30	Thesis	105

FOURTH YEAR. SECOND TERM

Business Administration B–46	90	Textile Design and Cloth Construction D-41	90
Cotton Finishing H–31	105	Thesis	135
Jacquard Design and Weaving D-40	105		

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Color and Dynamic Symmetry D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	75		
Principles of Marketing B–35	45		

Third Year. Second Term

Color and Dynamic Symmetry D–33	30	Statistics B-53	45
Cotton Yarn Manufacture F–30a	75	Textile Design and Cloth Construction D–30	75
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Marketing Methods B–36	60	Woolen and Worsted Finishing H–30	75
Power Weaving D-32	30		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Principles of Selling and Advertising B–49	105	Textile Styling B–50	30
Selling Policies B–52	45	Textile Testing B–43	60
Jacquard Design and Weaving D–40	60	Thesis	90

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31	75
Cotton Finishing H–31	105	Selling Policies B–52	45
Foreign Trade and Economic Geography B–51	45	Thesis	165

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.[

Mechanical Drawing—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals,

summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B-20a. Preparation: B-10. This subject is a continuation of the work of the first-year subject B-10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B-21. Preparation: B-10, B-12, B-13. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B-23. Preparation: B-10 and B-11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B-23a. Preparation: B-10 and B-11. This subject consists of the same topics as B-23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B-24. Preparation: B-12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B-25. Preparation: B-11, B-20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B-26. Preparation: B-11 and B-12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as

possible to commercial machine-shop practice on textile machinery. The list of tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B-30. Preparation: B-25. This is a continuation of Applied Mechanics B-25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B-31. Preparation: B-23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B-31a. Preparation: B-23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B-32. Preparation: B-12, B-20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B-33. Preparation: B-32. This course is a continuation of B-32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates. with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B-34. Preparation: B-21, B-25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B-34a. Preparation: B-21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B-34. [Courses I, II.]

Principles of Marketing—B-35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B-36. Preparation: B-35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Accounting—B-40. Preparation: B-10 and E-30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Textile Microscopy—B-41. Preparation: B-23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with acccompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B-47. Preparation: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B–48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B–49. Preparation: B–36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B–50. Preparation: D–30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B–51. Preparation: E–30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B–52. Preparation: B–36. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B–53. Preparations: B–20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Chemistry (Inorganic and Organic Chemistry)—C–10. Preparation: Admission Requirements. Instruction in Inorganic Chemistry extends through the first year, and includes lectures, recitations and laboratory work. The subject of Organic Chemistry is covered by lectures during the second term.

Elementary Inorganic Chemistry

During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C–11.

Elementary Organic Chemistry

This course includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C–20. [All courses.]

Qualitative Analysis—C–11. Preparation: C–10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C–10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as testing mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C–11a. Preparation: C–10, taken simultaneously. This course is similar to C–11, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C–12. Preparation: C–10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C–20. Preparation: C–10, B–12, B–13a. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents,

developing agents, mordanting assistants, mordanting principles and leveling agents.

THEORY OF DYEING.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

NATURAL ORGANIC COLORING MATTERS.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

MINERAL COLORING MATTERS.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

ARTIFICIAL COLORING MATTERS.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

MACHINERY USED IN DYEING.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C-21. Preparation: C-20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

Bleaching processes applicable to various animal and vegetable fibres are studied.

Work in color matching is also carried out on a laboratory scale. A fairly extensive study of the fastness properties of representative dyes of each class is taken up as well as their suitability for various classes of work.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Advanced Organic Chemistry—C-22. Preparation: C-10. In this course, which consists of lectures and recitations, the principles of organic substitution and synthesis are thoroughly discussed and as many illustrations are used as time

will permit, particularly such as are applied in the arts. The aliphatic series of hydrocarbons and their derivatives are studied for about twenty weeks, the remainder of the time being devoted to the benzine series. The aim of the course is to lay a broad foundation for the study of the chemistry of the artificial dyestuffs. Students are required to work out problems in the synthesis of various compounds, in order to become familiarized with equation writing. [Course IV.]

Quantitative Analysis—C-23. Preparation: C-11. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Talbot's "Quantitative Chemical Analysis" 1937 Edition is used as a text. [Course IV.]

Stoichiometry—C-24. Preparation: B-10, C-10, C-12. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C-30. Preparation: C-23. The fundamental principles acquired in Course C-23 are applied in this course in the examination of materials used in the textile mill the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. Griffin's" Methods of Technical Analysis" is used as a text. [Course IV.]

Industrial Chemistry (Lecture)—C-31. Preparation: C-22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's " Industrial Chemistry," Third Edition. Particular attention is paid to those subjects which are of special interest to the textile chemist, as oils, soaps, gas and coal-tar industry, building materials, and the manufacture on a large scale of important chemical compounds, such as the common acids and alkalies, bleaching powders, various mordants, etc. The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C-32. Preparation: C-20, C-21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–12. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Advanced Organic Chemistry—C–34. Preparation: C–22. This is a continuation of Advanced Organic Chemistry C–22. [Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory—C–36. Preparation: C–20, C–22, C–23. This course, while including practice in the usual methods of organic analysis, and giving excellent training in the principles and manipulations of general organic synthesis, is especially devoted to the synthetic dyestuffs. The student not only prepares many of the representative dyestuffs, but, what is far more important, he carries out all the operations, beginning with coal tar itself. Thus, instead of merely coupling two or more of the foreign imported intermediate products to make a dyestuff, he starts with the basic substances obtained from the coal tar and makes his own intermediate products. As far as is possible the student will be made acquainted with the problems which might arise in a dyestuff factory, and an excellent opportunity is presented for original work. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory—C–41. Preparation: C–34. This is a continuation of Organic Chemistry Laboratory C–34. [Course IV.]

Industrial Chemistry—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31. [Course IV.]

Chemical Textile Testing—C-43. Preparation: C-21, C-32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Statistical methods, relative humidity, regain, staple, hair weight, fiber resiliency, counts and denier, twist, evenness, cloth count, weight, crimp, thickness, porosity, permeability, waterproofness, wetting out, absorbency, shrinkage, thermal insulating value, handle or draping quality, wear or abrasion, strength and stretch.

Chemical Testing.—Ash, ash alkalinity, weighting, copper and manganese, acids and bases, sizing, oils, waxes. greases, soaps, fiber blends, baryta absorption, solubility in caustic, Methylene Blue absorption, copper number, fluidity in cuprammonia, nitrogen by Kjeldahl, sulfur by Benedict-Davis, ammonia nitrogen, Pauly test, solubility of wool in sodium hydroxide, viscosity of silk.

Optical Testing.—Colorimeter, tintometer, pH apparatus, refractometer, spectroscope, spectrophotometer, ultra-violet, infra-red, luster. [Course IV.]

Advanced Textile Chemistry and Dyeing—C-44. Preparation: C-32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C-45. Preparation: B-23, C-20, C-22. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon.

The lectures also include the subject of photomicroscopy. The laboratory course may be selected by the student as an optional course. [Course IV.]

Quantitative Analysis—C-46. Preparation: C-30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C-47. Preparation: B-20a, E-20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

Textile Literature—C-48. Preparation: C-47. This object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

Advanced General Chemistry—C-49. Preparation: C-10, C-11, C-24, C-34, C-42, C-46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Colloid Chemistry—C-50. Preparation: C-33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Adsorption, surface tension and wetting-out, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of irreversible emulsoids, protective colloids and detergents, gels, amorphous solids, use of X-rays, properties of proteins.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, paper, cellulose esters and lacquers, rayons, silk, wool, silk weighting, mordanting, dyeing, felting of wool. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C-51. Preparation: C-32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Elective Subjects or Thesis during fourth year—C-52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take elective work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931-32 several electives were introduced, each elective period being 45 hours per term and four of these being required during the year.

Thesis. If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more elective periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or elective subjects, will be required for graduation.

Photography. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

Photomicroscopy Laboratory. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both fibers and fabrics. Students taking this elective should have had Photography or the equivalent in experience.

Advanced Microscopy. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

Colloid Chemistry Laboratory. Experiments illustrating and amplifying the lecture course are performed. These may be on adsorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is usually in the form of directed research.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conducttivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

Textile—Chemical Engineering—Preparation: B–11, B–12, B–13, B–23, C–20, C–24, C–42. A combination of lectures and laboratory work designed for the study of the thermal properties of fluids, laws of thermo-dynamics as applied to batch and flow processes, flow of heat, mechanical mixtures, and heat engines.

This course will include such practical applications to the dyeing, printing, and finishing branches of the textile industry as efficient use of steam in heating dye kettles—steam traps—measuring of steam used—calculating steam costs—study of best methods of piping steam for manufacturing purposes and economics of hot water storage.

Compression and fluid handling, testing of pumps, fans and similar chemical engineering equipment including some calibration of instruments will serve to give the student a general over-view of elementary chemical engineering.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D–10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves,

checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D-20. For Cotton Goods—Preparation: D-10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D-21. For Woolen and Worsted Goods—Preparation: D-10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D-22. Preparation: D-10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D-23. Preparation: D-10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D-24. Preparation: D-10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, spooling and quilling, and the machinery for the same. A study is made of warpers and sizing machines for cotton, woolen, silk and rayon. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain

building, cam looms, automatic shuttle changing looms, dobby looms, single and double acting dobbies, Knowles looms, leno weaving, center selvedge motion, automatic filling changing looms, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, the cutting and lacing of cards, and tying up Jacquard harness. The Baker automatic attachment for mixing the filling is also considered. [Courses I, II, III, VI.]

Power Weaving—D-24a. Preparation: D-10. This is a lecture course given during the first term and covers briefly the fundamentals of weaving, types of looms suitable for weaving different fabrics, warp preparation, especially slashing machinery and compounds for rayon, cotton, woolen and worsted yarns. [Course IV.]

Textile Design and Cloth Construction—D-30. Preparation: D-20 or D-21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

Jacquard Design—D-31. This is a continuation of Jacquard Design D-23. [Course III.]

Power Weaving—D-32. Preparation: D-20, D-21, or D-23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen, worsted, cotton, silk and rayon; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. Automatic shuttle changing looms and automatic filling changing looms are taken up as well as the Baker attachment for mixing filling. [Courses I, II, III, VI.]

Color and Dynamic Symmetry—D-33. Color.—A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question.

Dynamic Symmetry.—A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. [Courses III and VI, Options D, S.]

Jacquard Design and Weaving—D-40. Preparation: D-23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D-41. Preparation: D-10, D-20, D-21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design

suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art for Special Students. This course is planned to give a student a working knowledge and appreciation of design. The first and second years are devoted to a general study of design, color, perspective, lettering and rendering. Drawings are made in the historic styles for all materials,—wood, gold, silver, copper, brass, leather, fabrics, wall papers and glass.

In the third year students should specialize and devote their attention to the material in which they expect to work.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E–10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E–11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E–20. Preparation: E–10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E–21. Preparation: E–11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E–30. Preparation: E–10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production,

land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

Seminar in Business English—E–40. Preparation: E–10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON DEPARTMENT — F

Cotton Carding—F–20. Preparation: B–10, B–12, B–13. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin, Nasmith, and Saco-Lowell combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used

to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine, jack, and long draft roving are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F–20a. Preparation: B–10, B–12, B–13. This course is similar to Course F–20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–25. Preparation: B–12, D–10. This course covers the same lectures and laboratory work as F–31. [Course VI, Option G.]

Cotton Spinning—F–30. Preparation: F–20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of regular and long draft ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions. The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F–30a. Preparation: F–20a. This course is similar to Course F–30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–31. Preparation: B–12, D–10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of

looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II, VI, Options C, W, S.]

Knitting—F-31a. Preparation: B-12, D-10. This course embraces the same lectures as Course F-31 but does not include any laboratory work. [Course VI, Option G.]

Cotton Organization—F-32. Preparation: F-20 or F-20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Knitting—F-35. Preparation: F-25. This course, given to students specializing in knitting, includes a more detailed study of hosiery and underwear manufacture with some time devoted to the manufacture of warp knit fabrics. [Course VI, Option G.]

Thesis—F-34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

Knitting—F-45. Preparation: F-35. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL DEPARTMENT—G

Fiber Preparation—G-20. Preparation: B-10, B-12, B-13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or which are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in scouring; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Carbonizing.—The various methods of stock carbonizing are explained in detail in the lecture course. Actual carbonizing of noil, burr waste, and defective wool is carried out by the sulphuric acid method on commercial size machines in the laboratory.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling

these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G–21. Preparation: B–10, B–12, B–13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.— Mixing and shading of colors and qualities of wool are studied and practiced. The details of Burr Pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W,D,S.]

Worsted Yarn Manufacture—G–30. Preparation: G–20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G–31. Preparation: B–23, F–30 or G–30, D–24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard

fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G–40. Preparation: C–21, C–32, D–10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H–30. Preparation: B–12, C–10, D–10, D–24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure. moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types

of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $330,850.00, is most varied for textile educational purposes, and is being constantly augmented. The builders of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of a 40-inch Saco-Lowell three beater single process picker.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different

frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B-5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat-lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division. — The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company.

Installed by C. G. Sargent's Sons Corporation: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc.: One 120-spindle cam mule complete.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son: One card grinding stand with two traverse grinders complete.

Shoddy or Reworked Fiber Division. — Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division. — Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill

box, Taylor-Wordsworth & Co., equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops; two worsted combs with baller punch, one made by Crompton & Knowles, and the second made by James Smith & Sons; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works. In addition to this the Saco-Lowell Shops have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory as well as in the testing laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system of six humidifiers and four Comin's High Duty heads, under automatic control.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery was made by the Sociéte Alsacienne de Constructions Mechaniques, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device, gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam -driven air compressor.

Textile Testing Division. — Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company; single yarn and fabric strength-testing machines made by G. R. Smith & Company; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company, a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, one General Electric mercury vapor lamp with stand for top inspection, one Edgerton stroboscope.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian

Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company. The Whitin Machine Company has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8 spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company.

The Weaving Department contains four looms supplied by the Draper Corporation, which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company. The Hopedale Manufacturing Company installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift. double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table. The Balance Room has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company.

The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé fractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with fifty-six steam heated dyeing baths and individual benches, reels and balances. There is also an ageing chamber and a Philadelphia Drying Machinery Company's Hurricane Dryer besides a large collection of dyestuffs.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, and a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine; a set of drying cans; a chain dyeing machine; a raw stock drying table; a padding mangle; a hydro-extractor; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company. The Franklin Process Company has furnished a 25-pound bronze dyeing machine.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company; a sample

fulling mill, a kicker mill, furnished by James Hunter & Company; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co.; a tentering and drying machine furnished by John Heathcote; a single crabbing machine, H. W. Butterworth & Son; a 72-inch woolen napper donated by Davis & Furber; a 32-inch basket hydro-extractor, W. H. Tolhurst; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company; a steam press for underwear, United States Hoffman Company; a sewing machine, Birch Brothers; a trimming and overseaming machine, The Merrow Machine Company.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine, Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber (the ball bearings were donated by the Fafnir Bearing Company); a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company; a trimming and overseaming machine, The Merrow Machine Company; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alden absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor

besides a General Electric 3-kilowatt rotary transformer and three Westinghouse stationary transformers. The other section is the instrument laboratory and is for the purpose of giving instruction in the measurement of current, voltage, resistance, and in the calibration of instruments. It is supplied with standard alternating and direct current measuring instruments of a wide range of sizes and capacities. A 160 ampere hour storage battery offers a source of constant voltage. A standard Leeds & Northrup photometer with Lummer-Brodhun screen and Macbeth illuminometer provide means of illumination measurements.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10 foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company; an engine lathe, 18-inch swing, 6 foot bed from Champion Tool Works; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son; one 14-inch single sensitive drill, from the Stanley Manufacturing Company; one No. 1 Universal grinder, from Landis Tool Company; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount; an American twist drill grinder, from the Heald Machine Company; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company; one 30-inch grindstone and frame, from the Athol Machine Company; a single spindle centering machine, from D. E. Whiton Machine Company; one 15-inch shaper, from Potter & Johnson; one power hacksaw, from the Fairbanks Company; one cold saw, from John T. Burr & Son; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

GRADUATES WITH TITLES OF THESES

June 7, 1938

Master of Science in Textile Chemistry

James Humphrey Parechanian, Lowell, Mass. B.T.C. 1935 Lowell Textile Institute. "Organic qualitative analysis and its application for the identification of commercial developer salts."

Master of Science in Textile Engineering

Ibrahim Zeki Acar, Istanbul, Turkey. B.Sc. Tech. 1936 University of Manchester, England. "A study of the effect of cloth construction on the strength and elongation of cotton fabrics."

Bachelor of Textile Chemistry

As thesis for the degree of Bachelor of Textile Chemistry is now optional, no thesis subjects have been listed.

Russell Denton Broadhurst	Middletown, Conn.
Hugh Francis Carroll	Medford, Mass.
Nelson Fletcher Getchell	Lowell, Mass.
Clinton Grossman	Providence, R. I.
Thomas Wadsworth Hardy	Lowell, Mass.
Winfield Hersey Howard	North Chelmsford, Mass.
Samuel Gilbert Kaplan	Lowell, Mass.
Robert Alphonse Lemieux	Lowell, Mass.
Helmuth Erich Lutz	Lowell, Mass.
Joseph Healey Mahoney	Andover, Mass.
John Peter Ploubides	Lowell, Mass.
Francis Joseph Qualey	Lowell, Mass.
Charles Warren Reddish	Cincinnati, Ohio
Leo James Sheehan	Dracut, Mass.
George David Sood	Woonsocket, R. I.
George Ward Wright, Jr.	Newtonville, Mass.

Bachelor of Textile Engineering

Kenneth Russell Fox, Lowell, Mass. "A study of the twist-strength relationship between single and two-ply worsted yarns." Thesis with George F. Wagner, Jr.

David Freeman, Boston, Mass. "A study of the legal and co-öperative methods of protecting fabric design."

Lorenzo Garcia Montero, Mexico City, Mexico. "A study of the effects of roll setting and draft upon the variability of cotton yarn."

Burgess Charles Harpoot, Lowell, Mass. "A study of three methods of determining twist in single cotton yarns."

Charles George Kelakos, Lowell, Mass. "A study of the twist-strength relationship between single and two-ply cotton yarns." Thesis with Edward J. Klosowicz.

Warren Thomas Kelly, Lowell, Mass. "Air permeability measurements."

Robert Miller Kennedy, Dunstable, Mass. "The design and construction of apparatus to measure the luster of textile fabrics."

Edward Joseph Klosowicz, Lowell, Mass. Thesis with Charles G. Kelakos.

Richard Greene Howland Knight, Jr., Fall River, Mass. "The determination of the possibilities for use of the Walen Evenness Tester in measuring commercially the evenness of single yarns of all kinds."

Carl Richard Littlefield, Lowell, Mass. "A study of the compressibility and resilience of fabrics."

Earl Edward Olsen, Reading, Mass. "An investigation of the possibility of using the verigraph to determine the regain of textile fabrics."

Walter Hale Paige, Jr., New Bedford, Mass. "A study of the relationship between the crimp in a cotton fabric and the elongation of that fabric."

Sidney Shapiro, Lowell, Mass. "A study of the use and merchandising of rayon staple fibre in the woolen and worsted men's wear industry."

George Frederic Wagner, Jr., Lowell, Mass. Thesis with Kenneth R. Fox.

Diploma in Cotton Manufacture

Kilburn Gray Pease, Lowell, Mass. "The manufacture of a spun rayon suiting."

Diploma in Wool Manufacture

George Woodrow Foss, Haverhill, Mass. "The manufacture of a worsted suiting."

Roger Hugh Kane, Cherry Valley, Mass. "The manufacture of a woolen cheviot coating."

Diploma in Textile Design

Reino Gust Lehto, Maynard, Mass. "The originating and making of a jacquard design of a fabric suitable for ladies' foundation garments."

Prizes awarded in June, 1938

The Medal of the National Association of Cotton Manufacturers awarded to the student who maintains the highest average in scholarship throughout the course. To *Kenneth R. Fox.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *Winfield H. Howard.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Arthur W. Lanner.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *Arthur S. Davis.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Sidney I. Saltsman.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *George S. Urlaub.*

REGISTER OF DAY STUDENTS

Graduate Students

Home Address	*Lowell Address*
Bethel, Ion Maywood, VI, Lowell, Mass. B.S., Texas Agricultural and Mechanical College, 1925	250 Nesmith Street
Lizak, Boleck Louis, IV, Chicago, Ill. B.S., Lewis Institute, 1937	50 Standish Street
Prien, Walter Ferdinand, VI, Milwaukee, Wis. B.S., U. S. Naval Academy, 1930	235 Princeton Boulevard
Smith, Lawrence, VI, Bloomfield, N. J. B.S., U. S. Naval Academy, 1932	28 Burtt Street
Steadman, Frank M., VI, Indianapolis, Ind. B.S., U. S. Military Academy, 1929	22 Fairgrove Avenue
Swiatek, Bronislaw John, VI, Shirley, Mass. B.S., Tri-State College, 1938	———

Undergraduate Students
Candidates for Degrees

Class of 1939

Baker, Phyllis Jeanne, VI, Concord, Mass.	692 Stevens Street
Banta, John Garret, VI, Lowell, Mass.	Phi Psi House
Beauregard, Albert Joseph, VI, Lowell, Mass.	258 Varnum Avenue
Bone, Arthur P. Stuart, VI, Lowell, Mass.	Phi Psi House
Brantman, Jackson Agmor, VI, New York, N. Y.	Phi Psi House
Buckley, Herman Timothy, IV, East Chelmsford, Mass.	———
Colby, Vernon Warren, IV, Haverhill, Mass.	———
Comins, Richard Coolidge, VI, Ballardvale, Mass.	———
Cunningham, Harold Russell, IV, Lowell, Mass.	7 Waite Street
Derzawetz, Joseph, VI, Boston, Mass.	———
Dick, Henry Kendal, Jr., VI, Lowell, Mass.	75 Fourth Avenue
Dori, Anita Marie, VI, Chester, Mass.	102 South Loring Street
Fox, Theodore Webster, VI, Lowell, Mass.	359 Beacon Street
Gianaris, George Demetrios, VI, Lowell, Mass.	678 Lakeview Avenue
Goodwin, John Alden, VI, Lowell, Mass.	111 Chestnut Street
Greene, John Lester, VI, Lowell, Mass.	388 East Merrimack Street
Jarek, Helen Jane, IV, Lowell, Mass.	74 Eleventh Street
Kahn, Seymour James, IV, Lowell, Mass.	116 Princeton Boulevard
Levin, Samuel, IV, Lowell, Mass.	43 Ware Street
Marsden, Sidney Robert, IV, Lawrence, Mass.	———
Miller, Arnold Irving, IV, Lowell, Mass.	268 Shaw Street
Monahan, Harold Joseph, IV, Dorchester, Mass.	———
Murphy, Hubert James, IV, North Chelmsford, Mass.	———
Ocoma, Estanislao Manaois, B.S., VI, Boston, Mass.	768 Merrimack Street
O'Donoghue, Eileen Margaret, VI, Lowell, Mass.	20 Columbia Street
Olsen, Herbert Charles, IV, Reading, Mass.	———
Patsourakos, James Peter, IV, Lowell, Mass.	19 Eighth Avenue
Prescott, William Benjamin, IV, Westford, Mass.	———
Reddish, Warren Thomas, Jr., IV, Cincinnati, Ohio	Phi Psi House
Reed, Everett Carlton, VI, Chelmsford, Mass.	———
Reed, William Thorncroft, VI, Lowell, Mass.	617 Westford Street
Rowntree, Clyde Burton, IV, Lowell, Mass.	32 Lane Street
Spevack, Edward, IV, Carlstadt, N. J.	Sigma Omega Psi House
Steinberg, Sidney, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Thomas, Henry Edward, VI, Lowell, Mass.	41 Bellevue Street
Winkler, Burton Cole, IV, Elizabeth, N. J.	Phi Psi House

Class of 1940

Home Address	*Lowell Address*
Aigen, Lawrence, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Balas, Fred Frank, VI, Lowell, Mass.	13 Third Street
Beltramini, Kenneth Charles, VI, West Englewood, N. J.	Phi Psi House
Brooks, Raymond King, VI, Unionville, Conn.	Omicron Pi House
Bullock, Merlen Clarke, VI, Lowell, Mass.	38 Burtt Street
Campbell, Andrew Morris, IV, Lawrence, Mass.	———
Chapman, Boyd Palmer, Jr., IV, Franklin, Mass.	Omicron Pi House
Davis, Arthur Sabin, IV, Lowell, Mass.	105 Inland Street
Falk, Stanley, VI, Brooklyn, N. Y.	123 Riverside Street
Feuerstein, James Mayer, VI, Jamaica Plain, Mass.	84 Gates Street
Fox, Louise, VI, Dracut, Mass.	———
Gill, John Schofield, IV, Andover, Mass.	———
Haas, Alexander Robert, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Hall, Richard Thomas, IV, Lowell, Mass.	54 Seventh Street
Hull, Robert Barney, VI, Lowell, Mass.	606 Stevens Street
Kiernan, James Vincent, VI, Dracut, Mass.	———
Lanner, Arthur William, IV, North Tewksbury, Mass.	———
Lynch, Edward Mark, IV, Lawrence, Mass.	———
McGilly, John Seede, VI, Lowell, Mass.	16 Talbot Street
Manning, Neil Joseph, IV, Lowell, Mass.	118 Mt. Washington Street
Maslanka, Edward John Felix, IV, Lowell, Mass.	5 Hampshire Street
Meuser, Rudolph Walter, VI, Pawtucket, R. I.	Omicron Pi House
Nelson, William Arthur, IV, Lowell, Mass.	896 Westford Street
Nuttall, Andrew Frederick, IV, North Billerica, Mass.	———
Pelt, Joseph, Jr., VI, South Orange, N. J.	Phi Psi House
Pero, Henry Leland, VI, West Willington, Conn.	Omicron Pi House
Roth, Paul, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Rovner, Albert Hyman, VI, Chelsea, Mass.	———
Silverman, Joseph Melvin, VI, Winthrop, Mass.	———
Sweatt, Safford Pershing, IV, Lowell, Mass.	124 Stevens Street
Thayer, Walter Stephen, VI, Bennington, Vt.	337 Beacon Street
Woodard, Malcolm Russell, IV, Chelmsford, Mass.	———

Class of 1941

Adie, Donald Miles, VI, Lowell, Mass.	26 Otis Street
Alexander, Gerard, VI, Kew Gardens, L. I., N. Y.	43 Plymouth Street
Bardzik, Thaddeus, IV, Dracut, Mass.	———
Batcheller, Ben Pitman, VI, Andover, Mass.	———
Biron, Joan Marguerite, VI, Lowell, Mass.	56 Fairlawn Street
Brown, Needham Ballou, Jr., VI, Andover, Mass.	———
Carmichael, Robert Dana, VI, Andover, Mass.	———
Casavant, Kenneth Arthur, IV, Gardner, Mass.	66 Riverside Street
Condon, John Andrew, Jr., IV, North Billerica, Mass.	———
Cordeau, George Edward, IV, Lowell, Mass.	1014 Lakeview Avenue
Curtin, Thomas Emmet, IV, Lowell, Mass.	49 Second Street
Dubrule, Louis Joseph, IV, Lawrence, Mass.	———
Epstein, Edward Joseph, IV, Newark, N. J.	Sigma Omega Psi House
Factor, Sidney Wilfred, IV, Haverhill, Mass.	———
Finard, Saunder, IV, Revere, Mass.	———
Finn, Joseph Francis, IV, Milton, Mass.	Phi Psi House
Fortier, George Charles, IV, Dracut, Mass.	93 Emery Avenue

Home Address	*Lowell Address*
Gari, Jose Via, VI, Mexico City, Mexico	11 White Street
Gass, Matthew, IV, Lowell, Mass.	201 Hildreth Street
Gatzimos, Aristophanes, IV, Lowell, Mass.	17 Little Street
Ginivan, William Francis, IV, Lowell, Mass.	50 Lamb Street
Greenbaum, Bernard Saul, IV, Haverhill, Mass.	———
Grondin, Abraham Hector, IV, Lowell, Mass.	111 Alma Street
Guilfoyle. Donald William, VI, Providence, R. I.	337 Beacon Street
Hamilton, Arthur Theodore, IV, Pittsfield, Me.	337 Beacon Street
Higginbottom, George Stephen, IV, Lowell, Mass.	46 Otis Street
Hoffmann, Donald Augustus, IV, Montclair, N. J.	75 Pine Street
Inkpen, Norman Alfred, IV, Ward Hill, Mass.	———
James, Ernest Peter, IV, Haverhill, Mass.	———
Jay, Joshua Daniel, VI, Brooklyn, N. Y.	43 Plymouth Street
Jones, Newton Adelbert, IV, Melrose, Mass.	———
Kaplan, Ralph Reuben, VI, Lowell, Mass.	43 Hawthorne Street
Keizer, Miriam Eleen, IV, Westford. Mass.	———
Koulas, Stanley Charles, IV, Chelmsford, Mass.	———
Landfield, Harold, IV, Dorchester, Mass.	445 High Street
Lane, Joseph James, 2nd, VI, Pittsfield, Me.	337 Beacon Street
Leary, Gordon Simpson, IV, Lowell, Mass.	834 Andover Street
Lewis, Dorothy Elaine, VI, Chelmsford, Mass.	———
Linden, Leo, VI, Chelsea, Mass.	———
McMahon, Joseph Justin, IV, Lowell, Mass.	7 Belmont Street
McTeague, George David, IV, Lowell, Mass.	298 Riverside Street
Mahan, Frederick Joseph, IV, Lowell, Mass.	825 Chelmsford Street
Mahoney, Francis Vincent, Jr., IV, North Billerica, Mass.	———
Mason, Frederick Rufus, VI, Lowell, Mass.	64 Orchard Street
Milberg, Maurice, VI, Brooklyn, N. Y.	75 Fourth Avenue
Mintz, Irving Paul, IV, Passaic, N. J.	148 Riverside Street
Murphy, Francis Arthur, IV, Brookline, Mass.	———
Okun, Seymour, VI, Brooklyn, N. Y.	337 Beacon Street
Patrick Stephen Edmund, Jr., VI, Augusta, Me.	343 Wilder Street
Pernick, David, VI, Maspeth, L. I., N. Y.	43 Plymouth Street
Phillips, Maurice Gordon, VI, Southbridge, Mass.	337 Beacon Street
Platt, Walter Wallace, IV, Lawrence, Mass.	———
Portilla, Jose Luis, VI, Mexico, D. F., Mexico	9 White Street
Puliafico, Salvatore Joseph, IV, Barre Plains, Mass.	59 Crescent Street
Rashkin, Bernard, VI, Brooklyn, N. Y.	19 Mt. Hope Street
Rich, Charlotte Merline, IV, Haverhill, Mass.	———
Roberts, Angus Henry, IV, Lowell, Mass.	35 Wiggin Street
Sakelaris, Dionysius John, IV, Lowell, Mass.	78 Varney Street
Saltsman, Sidney Irving, IV, Lowell, Mass.	89 Washington Street
Scarmeas, Harry George, IV, Lowell, Mass.	21 Hancock Avenue
Schiffer, Lathrope Adolph, VI, New York, N. Y.	Sigma Omega Psi House
Shore, James Cooper, IV, Lowell, Mass.	Omicron Pi House
Siegler, Frank Anthony, VI, Methuen, Mass.	Omicron Pi House
Sinski, Henry Anthony, VI, Gardner, Mass.	123 Pleasant Street
Skalkeas, Basil George, IV, Lowell, Mass.	53 Avon Street
Sullivan, Paul John, IV, Lowell, Mass.	33 South Walker Street
Szymosek, Frank John, IV, North Andover, Mass.	———
Tartikoff, Jordan Alvin, VI, Brooklyn, N. Y.	19 Mt. Hope Street
Tattersall, James, VI, West Roxbury, Mass.	———
Taylor, Roy Arnold, Jr., IV, Waltham, Mass.	———
Turner, George Robert, IV, Newark, N. J.	Phi Psi House
Upton, George Joseph, IV, Fitchburg, Mass.	409 Moody Street
Urlaub, George Samuel, IV, New York, N. Y.	43 Plymouth Street

Home Address	*Lowell Address*
Valvanis, Nicholas John, IV, Haverhill, Mass.	———
Webb, Ralph Peabody, VI, Dracut, Mass.	———
Weil, Clarence Bernard, IV, New York, N. Y.	148 Riverside Street
Wolf, Irving Jacob, VI, Morristown, N. J.	Sigma Omega Psi House
Woodard, Alice Marjorie. VI, Chelmsford, Mass.	———
Zellweger, Ralph John, VI, Palisade, N. J.	Phi Psi House
Zarules, George, IV, Peabody, Mass.	———

Class of 1942

Allard, Ernest Herbert, IV, Lowell, Mass.	104 Eleventh Street
Angell, Charles Francis, Jr., IV, Chestnut Hill, Mass.	137 Riverside Street
Armstrong, George Gordon, Jr., VI, Littleton, Mass.	———
Baer, Leonard Herman, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Barnes, Kenrick, IV, Billerica, Mass.	———
Barry, Gerard George, IV, Lowell, Mass.	539 Chelmsford Street
Bevington, Lawrence Elliot, IV, Lawrence, Mass.	———
Bloch, Seymour Samuel, VI, Brookline, Mass.	137 Riverside Street
Boule, Raymond George, IV, Lowell, Mass.	66 Mt. Hope Street
Brook, John Frederick, VI, Simcoe, Ont.	125 Mt. Washington Street
Brown, Chandler Russell, IV, Marblehead, Mass.	———
Caine, Philip Daniel, IV, Lowell, Mass.	89 Puffer Street
Campbell, John Duncan, VI, South Boston, Mass.	37 Varney Street
Chevrette, Henry Anthony, VI, Watertown, Mass.	———
Coffin, William Burton, IV, Melrose, Mass.	———
Corcoran, Leonard Robert, IV, Bradford, Mass.	———
Cozad, June Bernice, VI, Lowell, Mass.	136 Chestnut Street
Cryan, Thomas Francis, VI, Lowell, Mass.	59 Temple Street
Demitropoulos, Andrew Peter, VI, Dracut, Mass.	———
Dick, Rudolph Carl, Jr., VI, Beverly, Mass.	Phi Psi House
Dulligan, William Charles, IV, Lowell, Mass.	40 Saratoga Street
Eichner, Albert David, VI, New York, N. Y.	65 Sterling Street
Evans, Phillip Cameron, IV, Lowell, Mass.	228 Wentworth Avenue
Foye, Walter Francis, IV, Lowell, Mass.	484 Pine Street
Fuller, Samuel Lloyd, VI, Lowell, Mass.	106 Fairmount Street
Flood, Edward Robert, IV, Lowell, Mass.	89 Parkview Avenue
Freeman, Ralph, VI, Everett, Mass.	Sigma Omega Psi House
Galaher, Robert Brisbane, IV, North Andover, Mass.	———
Gill, Saul, VI, Haverhill, Mass.	———
Goodwin, James Augustine, IV, Andover, Mass.	———
Gross, Donald Joseph, IV, Haverhill, Mass.	———
Hakanson, Richard Andrew, IV, Winchester, Mass.	———
Hamer, David Orville, Jr., IV, Dracut, Mass.	———
Harper, Cyril Newcomb, IV, Wakefield, Mass.	———
Haseltine, Robert Clifton, IV, Haverhill, Mass.	Omicron Pi House
Hatch, Freeman Clark, 3rd, VI, North Andover, Mass.	———
Hornung, Sanford Lee, IV, Corning, N. Y.	137 Riverside Street
Hunter, Robert Arnold, VI, Lowell, Mass.	52 Harvard Street
Johnson, Roy Theodore, VI, Chelmsford, Mass.	———
Kent, George, VI, Great Neck, L. I., N. Y.	50 Standish Street
Koroskys, Michael Joseph, VI, North Andover, Mass.	———
Lau, Ching Sut, VI, Hongkong, China	65 Merrimack Street
Levine, Irvin, VI, Brooklyn, N. Y.	266 Gibson Street
Lisien, Walter, IV, Lowell, Mass.	85 Whipple Street

Home Address	*Lowell Address*
Loiselle, Lucien Hervé, IV, Lowell, Mass.	269 Fourth Street
Lygomenos, Peter Charles, IV, Peabody, Mass.	————
McCartney, Robert Wallace, IV, Lowell, Mass.	16 Sidney Street
McElhinney, Douglas Hamilton, IV, Passaic, N. J.	137 Riverside Street
McMahon, Stillman Dillon, IV, Lowell, Mass.	7 Belmont Street
Mandikos, George John, IV, Haverhill, Mass.	————
Moreau, Arthur Joseph, IV, Lowell, Mass.	45 West Street
Moskowitz, David, VI, New York, N. Y.	85 Washington Street
Murphy, John Anthony, IV, Lowell, Mass.	123 Andrews Street
Noonan, Paul Francis, IV, Lowell, Mass.	45 By Street
Oppenheim, Morton Lewis, VI, Lawrence, Mass.	————
Osgood, Russell Lawrence, IV, Lawrence, Mass.	————
Pappas, Vasil James, VI, Dracut, Mass.	————
Peel, Robert Kenneth, IV, Worcester, Mass.	53 Mt. Hope Street
Pettengill, Warren Martin, VI, Beacon, N. Y.	148 Riverside Street
Pierce, John Arthur, IV, Malden, Mass.	————
Pinatel, John Andre, IV, Paterson, N. J.	137 Riverside Street
Pratt, Caroline Elizabeth, IV, Lowell, Mass.	119 Fairmount Street
Rawlinson, Dustin, IV, Westville, N. H.	272 Merrimack Street
Roberts, Russell Frederick, VI, Chelmsford, Mass.	————
Rogoff, David, VI, Mattapan, Mass.	272 Merrimack Street
Roumas, Zenon Anthony, IV, Peabody, Mass.	————
Sandner, Charles Rodney, IV, Lawrence, Mass.	————
Sanford, George Morse, Jr., VI, Malden, Mass.	————
Schiffer, Clifford Elais, IV, New York, N. Y.	43 Plymouth Street
Schiller, William, VI, Brookline, Mass.	268 Shaw Street
Schlesinger, Morton, IV, New York, N. Y.	Sigma Omega Psi House
Shafter, Stuart Frederic, IV, Lowell, Mass.	373 Beacon Street
Shapiro, Jeffrey Joseph, VI, Brooklyn, N. Y.	43 Plymouth Street
Shepherd, Herbert Norris, VI, Hudson, N. H.	————
Sherman, Arthur Frank, IV, Lawrence, Mass.	————
Smith, Francis Dunham, VI, Dover-Foxcroft, Me.	137 Riverside Street
Staklinski, Walter Albert, VI, Rockville, Conn.	37 Varney Street
Strawbridge, James Roberts, VI, Lowell, Mass.	12 Marlborough Street
Szopa, Stanley, IV, Lowell, Mass.	39 Beacon Street
Thomas, Donald Henry, IV, Medford, Mass.	————
Tomasuria, Joseph Charles, VI, Lawrence, Mass.	————
Tully, George Thomas, IV, Southbridge, Mass.	359 Beacon Street
Varnum, Harold Abbott, VI, Greenfield, N. H.	50 Standish Street
Wall, James Thomas, IV, Lowell, Mass.	157 Pleasant Street
Walwood, John Thomas, IV, Lowell, Mass.	144 A Street
Washburn, Vincent Oliver, IV, Lakeville, Mass.	Trotting Park Road
Webster, Frederick Leonard, Jr., IV, Lowell, Mass.	167 D Street
Whiting, Frank Edward, IV, Andover, Mass.	————
Wolf, Irving Paul, IV, Brooklyn, N. Y.	Sigma Omega Psi House

Diploma Students

Class of 1939

Bauer, Frank Norbert, I, Waterloo, Ont.	226 Riverside Street
Cohen, Leonard Lee, II, Rochester, N. Y.	148 Riverside Street
Ekstrand, Frederic Lawrence, II, Stafford Springs, Conn.	Phi Psi House
Esielionis, Victor John, I, Shirley, Mass.	————
Gay, Clarence Russel, II, Lowell, Mass.	26 Fremont Street
Hackett, John James, II, Groton, Mass.	————
Kareores, Gregory George, II, Lowell, Mass.	52 Lewis Street

Little, Ralph Harding, II, Rockville, Conn.	Omicron Pi House
Merritt, Charles Adelbert, II, Rockland, Me.	Omicron Pi House
Scribner, James Woodbury, II, Manchester, N. H.	Omicron Pi House
Silberstein, Raymond, III, Lowell, Mass.	83 Washington Street
Stowell, Eldon, A.B., I, Williamstown, Mass.	288 Pawtucket Street
Wheelock, Silas Mandeville, Jr., II, Putnam, Conn.	Omicron Pi House
Wiesner, Arthur Charles, II, Lawrence, Mass.	———

Class of 1940

Hobson, Edward Shackford, III, Southbridge, Mass.	337 Beacon Street
Hockmeyer, Clive Edward, Jr., I, Lowell, Mass.	7 Whitman Street
Lannon, John Francis, Jr., II, Saylesville, R. I.	337 Beacon Street
Mackle, Chauncey Jacob, II, Cranston, R. I.	Omicron Pi House
Mejia, Eduardo, B. S., I, Medellin, Colombia, S. A.	247 Appleton Street
Proulx, Arthur Anthony, II, Lowell, Mass.	65 Sterling Street
Rees, Richard Holmes, I, Townsend Harbor, Mass.	———
Yacubian, Gamaliel Mardiros, II, Somerville, Mass.	———

Class of 1941

Blanchard, Armand Eugene, III, Southbridge, Mass.	173 A Street
Bulson, Douglas Whitney, II, Albany, N. Y.	43 Plymouth Street
Callahan, George Paul, II, Medford, Mass.	———
Fead, Robert William, II, Port Huron, Mich.	Phi Psi House
Garnett, Stanley Arthur, II, Edgewood, R. I.	Omicron Pi House
Macktez, Lester Allen, II, Woonsocket, R. I.	Sigma Omega Psi House
Paley, Herbert Melvin, III, Haverhill, Mass.	417 Westford Street
Pearsall, Samuel, II, Hamilton, N. Y.	337 Beacon Street
Peterson, Albert Cobb, II, Rockland, Me.	Omicron Pi House
St. Jean, Lawrence Raymond, II, Harrisville, R. I.	Phi Psi House

Specials

Brodsky, William, B. S., VI, New York, N. Y.	Sigma Omega Psi House
Cooper, Joseph Irvine, II, Brookline, Mass.	———
Halaby, William Edwin, I, Medellin, Colombia, S.A.	15 Douglass Road
Kaye, Harold, VI, Wilton, N. H.	———
Larkin, Charles Joseph, III, Methuen, Mass.	———
Londono, Gilberto Mesa, I, Medellin, Columbia, S. A.	298 Riverside Street
Madden, Francis Edward, III, Arlington, Mass.	———
Morton, Edward Knowlton, VI, Lowell, Mass.	32 Colonial Avenue
Scanlon, Joseph Cornelius, III, Lawrence, Mass.	———
Shea, Philip Joseph, III, Randolph, Mass.	———
Wessells, Joseph Francis, IV, Lowell, Mass.	31 England Street
Wilkinson, Freeman Firth, I, Thompson, Conn.	Omicron Pi House

ALPHABETICAL LIST OF GRADUATES

Master of Science degree was first given in 1936. Other degrees were issued beginning with the year 1913 as follows: B.T.C.—Bachelor of Textile Chemistry; B.T.D.—Bachelor of Textile Dyeing; B.T.E.—Bachelor of Textile Engineering. A diploma is indicated by D and a certificate (covering a partial course only) by C.

The following list has been corrected in accordance with information received previous to February 1, 1939. Any information regarding incorrect or missing addresses is earnestly solicited.

Abbot, Edward Moseley, II, '04 (D). President and General Manager, Abbot Worsted Company, Graniteville, Mass.

Abbott, George Richard, II, '08 (D). Tree Warden, Andover, Mass.

Acar, Ibrahim Zeki, VI, '38 (M.S.). Istanbul, Turkey, Hale Apt. No. 3, 'Sair Nigâr Sok Pangalte.

Adams, Floyd Willington, VI, '16 (B.T.E.).

Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.

Adams, Tracy Addison, IV, '11 (D). Vice-President and General Manager, Arnold Print Works, North Adams, Mass.

Albrecht, Charles Henry, IV, '17 (B.T.C.). Chief Chemist, Atlantic Mills, Providence, R. I.

Alcott, Albert Stephen, Jr., IV, '35 (B.T.C.), '36 (M.S.). With New England Telephone & Telegraph Co., Framingham, Mass.

Allard, Edward Joseph, IV, '31 (B.T.C.). Salesman and Demonstrator, National Aniline & Chemical Company, Providence, R. I.

Allen, Grover Stanley, IV, '34 (B.T.C.). With M. T. Stevens & Sons Co., Haverhill, Mass.

Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.

Anderson, Arthur Illman, IV, '24 (B.T.C.). Textile Chemist, Superintendent of Research, American Institute of Laundering, Joliet, Ill.

Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City.

Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Hathaway Manufacturing Company, New Bedford, Mass.

Anderson, Harold Robert, II, '26 (D). With Abbot Worsted Company, Forge Village, Mass.

Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.

Anthony, Henry Steere, Jr., IV, '36 (B.T.C.).

Appel, Mrs. Bessie L. (Lifland, Bessie), IV, '32 (B.T.C.). Assistant Chemist, Massachusetts Knitting Mill, Jamaica Plain, Mass.

Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Superintendent of Dyeing, Sayles Finishing Plants, Inc., Saylesville, R. I.

Arundale, Henry Barnes, II, '07 (D). Development and Research Engineer, Atwood Machine Company, Stonington, Conn.

Atwood, Henry Jones, II, '23 (D). Agent, Amos Abbott Company, Dexter, Me.

Babb, Charles Wilkes, Jr., II, '31 (D). With Knox Woolen Company, Camden, Maine.

Babigan, Edward, IV, '33 (B.T.C.). With Outlet Fruit Company, Lowell, Mass.

Babigan, Raymond, IV, '24 (B.T.C.). Examiner, United States Patent Office, Washington, D. C.

Bachelder, Charles Edward, IV, '24 (B.T.C.). Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.

Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). Time Study, Worsted Division, Pacific Mills, Lawrence, Mass.

Bailey, Lester Harold, IV, '24 (B.T.C.). 1018 Hope Street, Providence, R. I.

Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.

Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.

Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.

Baker, William John, IV, '16 (D). Manufacturing Superintendent, E. I. du Pont de Nemours & Co., Buffalo, N. Y.

Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.

Balch, Ralph Herman, VI, '29 (B.T.E.). Development Engineer, Celanese Corporation of America, Amcelle, Md.

Baldwin, Frederick Albert, II, '04 (D). President, Federal Clothing Manufacturing Company, Ltd., Sherbrooke, Que.

Bard, Morry Arnold, IV, '30 (B.T.C.). President, Silver Line Dye Works, Inc., New York City.

Barlofsky, Archie, VI, '17 (B.T.E.). Attorney at law, Barlofsky & Barlofsky, Lowell, Mass.

Barr, I. Walwin, I, '00 (D). 1st Vice-President, Buckley Brothers Company, 881 Broadway, New York City.

Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co. (Industrial Soap Division), North Bergen, N. J.

Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.

Barry, Marie Gertrude, IV, '32 (B.T.C.). In Charge of Fastness Tests, National Aniline & Chemical Co., Buffalo, N. Y.

Basdikis, Charles Apostolos, IV, '36 (B.T.C.). 8 Lagrange Street, Lowell, Mass.

Bassett, Louis Loss, VI, '37 (B.T.E.). Manufacturer, Glenbar Fabrics, Lowell, Mass.

Bates, Wesley Elliot, VI, '36 (B.T.E.). 4 Mechanic Street, East Milton, Mass.

Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.

Beattie, John Silas, IV, '35 (B.T.C.). Chemist, Pacific Mills, Lawrence, Mass.

Beck, Frederic Christian, II. '24 (D). In business. Weld & Beck. Southbridge. Mass.

Beeman, Earl Royal, VI, '30 (B.T.E.). Superintendent, No. 1 Mill, Pacific Mills, Dover, N. H.

Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline & Chemical Company, Buffalo, N. Y.

Bell, Edward Benjamin, IV, '24 (B.T.C.). Chemical Sales, Calgon, Inc., Lowell, Mass.

Bennett, E. Howard, II, '03 (C). Publisher, American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass.

Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.

Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.

Berry, Wilbur French, II, '17 (D).

Bertrand, Arthur Leon, IV, '32 (B.T.C.). Dyeing Department, United States Bunting Company, Lowell, Mass.

Bienstock, George Jerrard, III, '24 (D). Styler and Designer, Yorkshire Worsted Mills, New York, N. Y.

Billings, Borden Dickinson, I, '29 (D).

Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.

Bird, Francis John, VI, '22 (B.T.E.). Attorney-at-Law, 227 Bronson Building, Attleboro, Mass.

Birtwell, John Lincoln, IV, '34 (B.T.C.). Field Engineer, Armour Soap Works, North Bergen, N. J.

Blaikie, Howard Mills, II, '11 (D). Salesman, Kitchen Kraft Food Corporation, Brooklyn, N. Y.

Blake, Parker Gould, VI, '14 (D). Partner, Parker Blake & Clinton Long, Ltd., 54 Wellington Street, West, Toronto, Ont.

Blanchard, John Lawrence, II, '23 (D). Designer, Farnsworth Company, Lisbon Centre, Me.

Bodwell, Henry Albert, II, '00 (D). Ludlow Manufacturing Associates, 211 Congress Street, Boston, Mass.

Bogdan, John Francis, VI, '35 (B.T.E.). With Manville Jenckes Corporation, Manville, R. I.

Boordetsky, Sidney Morris, VI, '37 (B.T.E.). 77 Prentiss Street, Cambridge, Mass.

Booth, James Mooney, IV, '24 (B.T.C.). Salesman, The Huron Milling Company, 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Styler, Joshua L. Bailey & Co., 10-12 Thomas Street, New York City.

Boynton, Bradford Lewis, II, '35 (D). With Munro, Kincaid, Edgehill, Inc., Boston, Mass.

Brackett, Martin Richard, II, '22 (D). Selling Agent, 450 7th Avenue, New York City.

Bradford, Edward Hosmer, VI, '35 (B.T.E.). Research, Carding Department, Manville-Jenckes Corporation, Manville, R. I.

Bradford, Harold Palmer, II, '25 (D).

Bradford, Roy Hosmer, II, '06 (D). Textile Machinery Agent and Appraiser, 161 Devonshire Street, Boston, Mass.

Bradford, William Swanton, VI, '31, (B.T.E.). Assistant Superintendent, Dress Goods, Lawrence Manufacturing Company, Lowell, Mass.

Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.

Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.

Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, Inc., 325 West Huron Street, Chicago, Ill.

Brainerd, Carl Emil, IV, '20 (B.T.C.). Dyer, F. C. Huyck & Sons, Albany, N. Y.

Brandt, Carl Dewey, VI, '20 (B.T.E.). Research Engineer, Whitin Machine Works, Whitinsville, Mass.

Brannen, Leon Vincent, III, '07 (C).

Brickett, Chauncy Jackson, II, '00 (D). Director, Schools of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.

Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.

Bridges, Herbert Gardner, II, '34 (D). Office Manager and Representative, The New Hampshire Company, Portsmouth, N. H.

Brigham, Howard Mason, VI, '24 (B.T.E.). Sales Executor, Wellington, Sears Co., 65 Worth Street, New York City.

Broadhurst, Russell Denton, IV, '38 (B.T.C.). 2 Laurel Street, Middletown, Conn.

Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.

Brosnan, William Francis, IV, '27 (B.T.C.). Superintendent of Dyeing & Finishing, Farr Alpaca Company, Holyoke, Mass.

Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.

Brown, Philip Franklin, II, '23 (D). Assistant Sales Director, E. I. DuPont de Nemours, Rayon Division, Wilmington, Del.

Brown, Rollins Goldthwaite, IV, '12 (D).

Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.

Brown, Will George, Jr., IV, '22 (B.T.C.). Sales Technologist, Wallerstein Company, 180 Madison Avenue, New York City.

Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.

Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.

Bukala, Mitchell John, IV, '34 (B.T.C.). With Massachusetts Mohair Plush Company, Lowell, Mass.

Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.

Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.

Burke, James Edward, Jr., IV, '34 (B.T.C.). With Newmarket Manufacturing Company, Lowell, Mass.

Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous, Inc., Lawrence, Mass.

Burns, Robert, IV, '28 (B.T.C.).

Burtt, Joseph Frederic, VI, '31 (B.T.E.). With Abbot Worsted Company, Forge Village, Mass.

Buzzell, Harry Saville, VI, '29 (B.T.E.). Supervisor of Sample Department, Oxford Paper Company, Rumford, Maine.

Calder, Marian Brownson, VI, '37 (M.S.). (B.S. 1930, College of Industrial Arts, Texas State College for Women.) Teacher, Centenary Junior College, Hackettstown, N. J.

Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.

Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.

Campbell, Alexander, VI, '23 (B.T.E.). Assistant Engineer, Arlington Mills, Lawrence, Mass.

Campbell, Allan, Jr., VI, '32 (B.T.E.). With A. & A. Campbell Co., South Boston, Mass.

Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place Boston, Mass.

Campbell, Orison Sargent, II, '03 (D). Managing Director, Industrial Felts, Ltd., Kitchener, Ont.

Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Manager, Carlton Hotel, Malden, Mass.

Carbone, Alfred John, IV, '31 (B. T. C.). Chemist, Sandoz Chemical Works, Philadelphia, Pa.

Carleton, Joseph Raddin, III, '30 (D). Designer, Bridgeport Fabrics, Inc., Bridgeport, Conn.

Carr, George Everett, I, '05 (D). 343 5th Street, Ridgefield Park, N. J.

Carr, Paul Edward, II, '24 (D). Styler, Deering, Milliken & Co., 450 Seventh Avenue, New York City.

Carroll, Hugh Francis, IV, '38 (B.T.C.). Research Chemist, American Institute of Laundering, Joliet, Ill.

Carter, Robert Albion, IV, '02 (D). District Manager, DuPont Dyestuffs, E. I. du Pont de Nemours & Co., Philadelphia, Pa.

Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.

Cary, Julian Clinton, VI, '10 (D). Branch Manager, The American Mutual Liability Insurance Company, 12 Haynes Street, Hartford, Conn.

Casey, Francis Harold, IV, '31 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., Boston, Mass.

Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton, N. J.

Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.

Chandler, Proctor, IV, '11 (D). Styling and Selling, 444 Fourth Ave., New York City.

Chang, Chi, VI, '23 (B.T.E.).

Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Spinning & Weaving Co., 392 Nanking Road, Shanghai, China.

Chapman, Leland Hildreth, VI, '24 (B.T.E.). Pepperell, Mass.

Chen, Shih Ching, IV, '22 (B.T.C.).

Chen, Wen-Pei, IV, '24 (B.T.C.). Shanghai Bureau of Inspection, Shanghai, China.

Church, Charles Royal, II, '06 (C). Teacher and Athletic Coach, San Diego High School, San Diego, Calif.

Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.

Clark, Earl William, IV, '18 (B.T.C.). Chemist, National Aniline & Chemical Co., Inc., Buffalo, N. Y.

Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.

Clarke, George Dean, II, '21 (C). 338 East Main Street, Avon, Mass.

Clayton, Harold Edmund, VI, '21 (B.T.E.). Manager, Clayton Hosiery Mills, Inc., Lowell, Mass.

Cleary, Charles Joseph, II, '13 (D). Textile Technologist, United States Army Air Corps, Dayton, Ohio.

Clement, David Scott, IV, '24 (B.T.C.). Overseer of Dyeing, Nashua Manufacturing Company, Nashua, N. H.

Cleveland, Richard Sumner, VI, '30 (B.T.E.). Textile Technologist, National Bureau of Standards, Washington, D. C.

Clifford, Albert Chester, VI, '22 (B.T.E.). Textile Engineer, Western Electric Company, Inc., Kearny, N. J.

Clogston, Raymond B., IV, '04 (D). Divisional Superintendent of Dyeing, Merrimack Manufacturing Company, Lowell, Mass.

Cluett, John Girvin, I, '29 (D). Sanforizing Engineer, Cluett, Peabody & Co., Inc., Troy, N. Y.

Coan, Charles Bisbee, IV, '12 (D). Salesman and Demonstrator, American Aniline Products Company, Boston, Mass.

Cobb, Joseph Calvin, VI, '36 (B.T.E.). 504 Riverside Avenue, Trenton, N. J.

Coffey, Daniel Joseph, III, '28 (D). Blanket Inspector, F. C. Huyck & Sons, Rensselaer, N. Y.

Cohen, Arthur Edward, IV, '23 (B.T.C.). With National Hosiery Dyeing and Finishing Works, Boston, Mass.

Cohen, Raphael Edvab, IV, '25 (B.T.C.). Sales Manager, Merrimack Paper Tube Company, Inc., Lowell, Mass.

Colby, J. Tracy, VI, '16 (D). Sales Manager, F. C. Huyck & Sons, Empire State Building, Room 3318, New York City.

Colby, Willard Alvah, Jr., IV, '30 (B.T.C.). Assistant Superintendent, Hohokus Bleachery, Hohokus, N. J.

Cole, Edward Earle, IV, '06 (D). 191 Merrimack Street, Haverhill, Mass.
Collonan, Herbert Joseph, II, '22 (D). With Potter & Collonan, Moosup, Conn.
Coman, James Groesbeck, I, '07 (D). General Manager, Mexia Textile Mills, Mexia, Texas.
Conant, Harold Wright, I, '09 (D). Assistant Treasurer & Director, United Elastic Corporation, Easthampton, Mass.
Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears Company, 65 Worth Street, New York City.
Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.
Connolly, Daniel Francis, Jr., VI, '35 (B.T.E.). With Naumkeag Steam Cotton Company, Salem, Mass.
Connor, Thomas Francis, II, '28 (D). North Cohasset, Mass.
Connorton, John Joseph, Jr., III, '27 (D).
Cook, Kenneth Bartlett, I, '13 (D). Vice-President in Charge of Manufacturing, Manville-Jenckes Company, Manville, R. I.
Corbett, James Francis, IV, '28 (B.T.C.). Chemist, Pacific Mills, Lawrence, Mass.
Cote, Theodore Charles, IV, '26 (B.T.C.). Chemist, Merrimack Manufacturing Company, Lowell, Mass.
Cowan, Raymond Bernard, IV, '35 (B.T.C.). Of Cowan & Shain, 280 River Street, Haverhill, Mass.
Craig, Albert Wood, IV, '07 (D). Superintendent, Windsor Print Works, North Adams, Mass.
Craig, Clarence Eugene, III, '02 (D). 1730 Centre Street, West Roxbury, Mass.
Crane, Eugene Francis, II, '33 (D). Technician, East Weymouth Wool Scouring Company, East Weymouth, Mass.
Crawford, Robert Thomas, VI, '36 (B.T.E.). Development Engineer, Tennessee Eastman Corporation, Kingsport, Tenn.
Creese, Guy Talbot, IV, '14 (D). Leather Manufacturer, Creese & Cook Company, Danversport, Mass.
Crowe, Joseph Bailey, IV, '25 (B.T.C.). Director of Laundry and Textile Research, Procter & Gamble Co., Ivorydale, Ohio.
Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.
Cummings, Edward Stanton, VI, '16 (D). Industrial Engineer, Ralph E. Loper, Greenville, S. C.
Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.
Currier, Herbert Augustus, I, '06 (D). Vice-President, Waterman, Currier & Co., Inc., 40 Worth Street, New York City.
Currier, John Alva, II, '01 (D). Mechanical Superintendent, M. T. Stevens & Sons Co., North Andover, Mass.
Curtin, William John, IV, '35 (B.T.C.). Insurance Agent, John Hancock Mutual Life Insurance Company, Lowell, Mass.
Curtis, Frank Mitchell, I, '06 (D). Retail Lumber, Wm. Curtis Sons Company, 10 Blue Hill Parkway, Milton, Mass.
Curtis, William Leavitt, II, '05 (C).
Cutler, Benjamin Winthrop, Jr., III, '04 (D). Department Manager, Worth Textile Company, 40 Worth Street, New York City.

Daley, Charles Lincoln, IV, '34 (B.T.C.). Instructor, Chemistry Department, Lowell Textile Institute, Lowell, Mass.
Dalton, Gregory Smith, IV, '12 (D).
Daly, William James, VI, '37 (B.T.E.). Executive Training Group, Sears-Roebuck Company, Cambridge, Mass.
Danahy, Arthur Joseph, IV, '31 (B.T.C.). Chemist, Ciba Company, Inc., 325 West Huron Street, Chicago, Ill.
Darby, Avard Nelson, II, '28 (D). Superintendent, Plant No. 2, Merrimac Hat Corporation, Amesbury, Mass.
Datar, Anant Vithal, VI, '24 (B.T.E.). Managing Director, Venkatesh Rang Tantu Mills, Inchalkaranji, S. M. Cy., India.
Davidson, Sydney, III, '28 (D). 301 Allston Street, Brighton, Mass.
Davieau, Alfred Edward, VI, '16 (D). Textile Engineer, Mill Service Department, United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J.
Davieau, Arthur Napoleon, VI, '13 (D). Superintendent, Kenwood Mills, Ltd., (F. C. Huyck & Sons), Arnprior, Ont.
Davieau, Leon Arthur, VI, '23 (B.T.E.). With United States Rubber Products, Inc., Passaic, N. J.

Davis, Alexander Duncan, VI, '14 (B.T.E.). Instructor, Northeastern University, Springfield, Mass.
Dearborn, Roy S., VI, '13 (D). With Real Estate Department, Andover Savings Bank, Andover, Mass.
deGruchy, James Campbell, Jr., IV, '36 (B.T.C.). Chemist and Dyer, Goodall Worsted Company, Sanford, Me.
Del Plaine, Parker Haywood, IV, '25 (B.T.C.). Southern Manager, Rohm & Hass Company, Inc., 1109 Independent Building, Charlotte, N. C.
Dempsey, Phillip Edward, IV, '33 (B.T.C.). Chemist, American Aniline Products, Inc., Boston, Mass.
Derby, Roland Everett, IV, '22 (B.T.C.). Chemist, M. T. Stevens & Sons Company, North Andover, Mass.
de Sa, Francisco, VI, '18 (B.T.E.). Avenue da Graca, Bahia, Brazil.
Dewey, James French, II, '04 (D). President and Treasurer, A. G. Dewey Company, Quechee, Vt.
Dewey, Maurice William, II, '11 (D). 8 Bailey Avenue, Montpelier, Vt.
Dillon, James Henry, III, '05 (D).
Dion, Ernest Lorenzo, IV, '35 (B.T.C.). With Ayer Mill, Lawrence, Mass.
Dods, James Barber, II, '27 (D). Vice-President, The Dods Knitting Company, Ltd., Orangeville, Ont.
Dolan, William Francis, IV, '28 (B.T.C.).
Donald, Albert Edward, II, '04 (D). Agent, H. T. Hayward Company, Franklin, Mass.
Donohoe, Edward Joseph, VI, '34 (B.T.E.). Manager, New York Laboratory, United States Testing Company, Inc., 1450 Broadway, New York City.
Donovan, Joseph Richard, IV, '24 (B.T.C.). 81 Strathmore Road, Brookline, Mass.
Doran, Wilbur Kirkland, II, '22 (D).
Dorr, Clinton Lamont, VI, '14 (D). General Manager, Raymond's, Inc., 356 Washington Street, Boston, Mass.
Douglas, Walter Shelton, II, '21 (D). Estimator, Douglas & Co., Lowell, Mass.
Dudley, Albert Richard, VI, '33 (B.T.C.). With Chicopee Manufacturing Corporation, Manchester, N. H.
Duggan, Paul Curran, IV, '31 (B.T.C.). Chemist, Gotham Silk Hosiery Company, 580 First Avenue, New York City.
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Huising, Geronimo Huerva, I, '08 (D).

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Mitchell, Charles Alvah, II, '24 (D).

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Murray, James Andrew, II, '10 (D). Analyst, Massachusetts Unemployment Compensation Commission, Boston, Mass.

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Paul David Petterson . . . . . . East Chelmsford.
Assistant Instructor in Machine Shop Practice.

Herman Timothy Buckley . . . . . . East Chelmsford.
Student Instructor in Chemistry.

Vernon Warren Colby . . . 25 South Kimball Street, Bradford.
Student Instructor in Chemistry.

Theodore Webster Fox . . . . . . 359 Beacon Street.
Student Instructor in Textile Design.

John Alden Goodwin . . . . 111 Chestnut Street.
Student Instructor in Cotton Yarns.
Henry Edward Thomas . . . . 41 Bellevue Street.
Student Instructor in Mechanical Drawing.
Walter Ballard Holt . . . . 37 Albert Street.
Bursar.
Florence Moore Lancey . . . . 46 Victoria Street.
Librarian.
Helen Gray Flack, S.B. . . . . 445 Stevens Street.
Secretary.
Mona Blanche Palmer . . . . 685 Westford Street.
Clerk.
Miriam Kaplan Hoffman, S.B. . . . . . 42 Gertrude Avenue.
Clerk.
Howard Dexter Smith, Ph.D. . . . . . Dalton Road, Chelmsford.
Evening Instructor in General Chemistry.
Edward W. Dooley . . . . 799 Chelmsford Street.
Evening Instructor in Show Card Design.
J. Raymond Bradley . . . . 246 Andover Street.
Evening Instructor in Show Card Design.
James C. Buzzell . . . . 100 Park Avenue, East.
Evening Instructor in Electricity.
Glen Bowden Caswell . . . . 32 Hampshire Street.
Evening Instructor in Machine Shop.
Bertha C. Hoellrich, B.S. . . . . . . 99 Park Street, Newton.
Evening Instructor in Art.
Donald L. Hemmenway . . . . 85 Belrose Avenue.
Evening Instructor in Electricity.
Inez L. Keller, B.S. . . . . . 22 Chestnut Street, Winchester.
Evening Instructor in Art.
Ivar O. Moberg . . . . 64 Thirteenth Street.
Evening Instructor in Weaving.
Margaret L. Smith . . . . 62 Florence Avenue.
Evening Instructor in Art.
Harold R. Anderson . . . . R.F.D., Westford.
Evening Instructor in Worsted Yarns.
George P. Silva . . . . 20 Cheever Avenue, Dracut.
Evening Instructor in Diesel Engines.
Francis L. Dacey . . . . 10 Royal Street.
Evening Instructor in Geometry.
Lucy Robbins Weinbeck, B.T.E. . . . . . 192 Wentworth Avenue.
Evening Instructor in Design.
John H. Flood, S.B. . . . . 89 Parkview Avenue.
Evening Instructor in Mathematics.
William J. Chenard . . . . North Billerica.
Evening Instructor in Weaving.

CALENDAR.

1939.

September 21, Thursday	Registration.
September 28, Thursday	Registration.
October 2, Monday	Opening of evening school.
October 12, Thursday	Columbus Day—Holiday.
November 11, Saturday	Armistice Day—Holiday.
November 23, Thursday } November 24, Friday }	Thanksgiving recess. No classes.
December 19, Tuesday	End of first term.

1940.

January 4, Thursday	Opening of second term.
March 8, Friday	Closing of evening school.
April 4, Thursday	Graduation.

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week*. Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain

knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

111. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made.

Two evenings each week.

Cotton.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cotton desired and securing delivery at a known price.

Opening and Picking.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doub-

lings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

Roving.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

Ring Spinning.—A study of the various types of yarns gives the student an appreciation of the necessary characteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studied in detail. Important machine parts, such as rings, builders, guides and travelers, their adjustment and care, form an important part of this subject. Yarn faults and defects are shown and their causes explained.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

113. Knitting—1 Year.

This is a general course on the manufacture of knitted fabrics and garments, intended for those interested in the principles of knitting and a study of the mechanisms of a variety of knitting machines. The more important phases of the course are:—

Yarns and Yarn Sizing Systems.—In order that the student may understand the distinctions between yarns, terminology, and the various sizing systems commonly used, several lectures are devoted to yarn characteristics and sizing as a basis for the entire course. This covers cottons, woolens, worsteds, silks and rayons.

Flat Machines.—These relatively simple machines make a fine starting point in establishing clearly the action of the latch needle and how it is operated. Lamb, Dubied, Grosser, and Links and Links machines are used as a basis for this part of the work.

Small Circular Ribbers.—These machines are a very logical step, following flat machines. Brinton, Wildman, and Universal ribbers, with different pattern mechanisms, are used in illustrating this type of work.

Automatic Hosiery Machines.—This section of the course is built around the various Banner and the Scott and Williams half and full hose machines. Most of the work is done with the plain machines as there is not sufficient time to include the fancy pattern type.

Large Ribbers and Spring Needle Machines.—Underwear fabric and webbing are produced on this type of equipment. Scott and Williams, Wildman and Crane machines are the basis for instruction along these lines.

Full Fashioned Machine.—A brief study of the full fashioned principles and actions is based on the Reading 18-section machine in the laboratory.

Warp Knitting.—Using the Raschel machine in the laboratory, a general study of warp knitting includes Tricot and Milanese work also.

Analysis.—During the study of the various machines, considerable attention is given to the many "stitches" possible. This, coupled with the lectures on fabric and hosiery analysis, covers the common analysis problems.

Routines.—The usual sequence of manufacturing processes for hosiery and underwear are studied with the idea of illustrating the steps necessary in producing different articles.

Most of the instruction in this course is given by lectures. As many of these machines are small, it is common practice to bring the machine under discussion into the classroom so that students may see the machine and parts being considered. In other instances, the class may go into the laboratory to see the equipment and its operation.

114. Cotton Organization—1 Year.

This course, offered only to those who have completed the work in Carding and Spinning, is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

211. Woolen Yarns—1 Year.

Instruction consists of lectures on technology of wool fiber (for detailed description see Course 217) and woolen yarn manufacture. This covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Reworked fiber (shoddy) is covered in detail from rag sorting to finished staple.

Three evenings each week.

217. Wool and Top Making—1 Year.

Instruction consists of lectures in technology of wool fibers, worsted carding and combing, and mechanism and calculations.

Technology of Wool Fibres—*one evening each week.*

Raw Materials.—The study of raw materials which enter into the manufacture of woolen or worsted yarns or hardened felts, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel hair, cut staple rayon, etc. In connection with these are considered shoddy, noils, and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lectures. The various characteristics and properties are explained, as are also trade terms, such as Fine, ½-blood, ⅜-blood, 56^s, 36^s, B super, delaine, braid, etc. Over 1,500 samples of wool and other fibers gathered from all the countries of the world are catalogued and are available for inspection and study. Wool shrinkages are studied as are also spinning qualities. A complete collection of literature pertaining to sheep, wool, etc. is available for outside reading or study.

Wool Scouring.—The objects of scouring or degreasing and the methods employed are explained. This involves the consideration of soaps and chemicals used in scouring and degreasing, also the waste products and their utilization. A sorted lot of grease wool is scoured by machines that are made similar in operation to regular commercial wool scouring machines. At the same time the use of driers, their operation and regulation, is taken up.

Carbonizing.—The methods of carbonizing wool, noils, burr waste, rags, etc. are studied. If time permits, a commercial quantity of stock is carbonized on the regulation carbonizing machines in the wool laboratory.

Worsted Carding and Combing—*one evening each week.*

Carding.—The different types of worsted cards are studied in detail, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application, grinding, setting, etc.

Combing.—This branch takes up the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and Noble comb is studied by lectures. Two Noble combs are available for inspection and study.

Mechanism and Calculations—*one evening each week.*

This subject gives the principles of the various mechanisms used in wool manufacturing machines. Among the topics dealt with are—equations, surface speed, R. P. M., drivers, drivens, draft and production calculations, stop motions, combing layouts, levers, logarithms, top testing, calculations, etc.

218. Worsted Yarns—1 Year.

Instruction is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule or frame. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

219. Air Conditioning—2 Years.

The subjects covered in this course include the following; fundamental laws, principles and definitions; physical properties of the atmosphere; explanation of words and terms used, such as—matter, energy, heat, heat energy, temperature, ice, water, vapor, gas, steam, thermometers, hygrometers, hydrometers, barometers, pressure, gage pressure, absolute pressure, absolute temperature, laws of gases, heat units, vapor pressure, dew point, evaporation, condensation, precipitation, relative and absolute humidity; sensible heat, latent heat, specific heat, total heat of air, effective temperature, comfort zones, air movement, ventilation; movement of heat and air, infiltration, conduction, solar heat, air breakage; heat from human beings; lights, machinery and processes; humidification and dehumidification, heating and cooling, air filtration, air washing; refrigeration and refrigerants, cooling by water, ice, typical air-conditioning equipment, typical control equipment, thermostats, humidostats, wet and dry bulb type; use of charts and tables, costs, etc.

Students are required to hand in complete details for producing prescribed conditions of temperature and humidity in some building in or near Lowell, Mass., before completing the course.

One evening each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern,

are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quilting, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313. Decorative Art—3 Years.

The first year work consists of charcoal drawing from plaster models and group arrangements of still life for ten weeks. The second ten weeks deals with pastel drawing of still life groups.

Two evenings each week.

During the second year instruction is given in color harmony—a study of color and variety of effects obtainable.

Two evenings each week.

In the third year the student chooses one of the following options:

1. Life Drawing—drawing from model.
2. Painting—either in oils or water color of still life groups.
3. Perspective—a study of the mechanical approach to correct drawing.

Two evenings each week.

314. Show Card Design—2 Years.

LETTERING.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with

the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods of detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.
Laboratory Work in Analytical Chemistry.
Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

ENGLISH DEPARTMENT

511. English Composition—2 Years.

First Year.—Remedial English and Rhetoric.—In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing in a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles. The course of instruction consists of lectures, recitations, remedial exercises, and the study of a text book.

One evening each week.

Second Year.—The Principles of Composition.—This is an advanced course and is not open to students who have not completed the first year or its equivalent. The primary purpose of this course is to give the student the ability to write clearly and correctly. An intensive study is made of the four divisions of composition—narration, description, exposition, and argumentation— and the art of letter writing. Selections from various authors to be read for general interest and for the purpose of illustration, are assigned for outside reading. Lectures are given; and home work, the study of a text book, and examinations are required.

One evening each week.

512. Appreciation of Literature—1 Year.

This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

Two evenings per week.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, Shop Mathematics, Mechanics, and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

Two evenings each week.

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horsepower, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires home problem work and the study of a text book.

Two evenings each week.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

Two evenings each week.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

Two evenings each week.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on

such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

Two evenings each week.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. A considerable amount of home study and preparation is required. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

Two evenings each week.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work.

Two evenings each week.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated. A text book is required.

Two evenings each week.

626. Mill Illumination—1 Year.

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

Two evenings each week.

628. Selling and Advertising—1 Year.

This course covers the basic principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

Two evenings each week.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears,

gearing, cams and similar topics. Home problem work and the study of a text book are required.

Two evenings each week.

631. Plane Geometry—2 Years.

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

Two evenings each week.

632. Diesel Engines—1 Year.

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

Two evenings each week.

633. Shop Mathematics—1 Year.

This subject deals with the practical application of mathematics which is of the greatest use to machinists or those in similar lines of work. It consists of those parts of arithmetic, algebra, geometry and trigonometry, which are essential in modern machine shop practice. Some of the topics are:—fractions and decimals, logarithms, problems in ratio and proportion, areas of surfaces, calculation of angles, solution of right and oblique triangles.

In addition to the mathematical work, the scientific principles which govern the operation of various machines are studied. In this connection the following topics are included:—verniers and micrometers, levers, belt and gear speeds, screw threads and screw cutting, gear tooth computations, plain and differential indexing. This subject requires home problem work and the study of a textbook.

Two evenings each week.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double

cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1939.

Certificates awarded as follows, April 17, 1939:

Knitting—1 Year.

ophie Krofka, Lowell
obert Keith Lyle, Lowell
harles Overton, West Stoughton
Henry Raymond Rioux, Lowell
Adolf John Savicki, Brockton

Woolen Yarns—1 Year.

rnest Augustus Borden, Bradford
orman Edgar Floris, Methuen
hilip Midgley, No. Andover
Walter Leo O'Neil, East Acton
Edward Joseph Sanford, Lawrence
Gilbert Kingsley Switzer, Wellesley

Worsted Yarns—1 Year.

Villiam Rimmington Addy, Dorchester
eorge T. Cosman, Cambridge
larence Warren Mooar, Andover
Norman Eric Roberts, Lawrence
Albert Austin Sanford, Lowell

Worsted Yarns—2 Years.

eter Belida, No. Chelmsford

Wool and Top Making—1 Year.

aoul Lionel Caron, Forge Village
rthur Bernard Charlesworth, Methuen
incent John Connell, Lawrence
obert Vincent Coté, Lawrence
tanley John Dixon, Lowell
dward Lorenzo Hapshe, Lawrence
oseph Augustine Hicks, Lawrence
rancis Earl Humphrey, Lowell
ana Francis Igo, Canton
ohn Joseph Janowski, Lawrence
ictor John Krukonis, Methuen
ene Lionel Lacharite, Lawrence
George William Larkin, Cambridge
Walter Stoddart MacLauchlan, Methuen
Robert Lee Mack, Brookline
Peter Francis Neary, Wollaston
Norman Newton, Forge Village
Vincent John Noble, Methuen
Joseph Patrick O'Connor, Roxbury
Edmund Joseph O'Donnell, Medford
Anthony Peter Palermo, Methuen
Richard William Schreiber, Andover
Richard Oades Sykes, Jr., Lowell
Jay Moody Worsfold, Waltham

Air Conditioning—2 Years.

ames Raymond Cote, Lowell
aven Arthur Strout, Lowell
Thaddeus Walter Albert Stys, Lowell

Cotton Design—3 Years.

dward Mitchell Jawinski, Lowell
ugustin Legere, Shirley
Richard Anthony Morris, Lowell

Woolen and Worsted Design—3 Years.

rnest Frederick Ammon, Lawrence
incent Anthony Balezentes, Lawrence
aymond Arthur Bardsley, Lawrence
ichard Hubbard Cook, Lowell
alter LeRoy Cummings, Dover, N. H.
oseph Nathaniel Duckett, Andover
larence Raymond Greenwood, Lawrence
Albert Joseph Kendall, Lawrence
James Arthur Kenyon, Lowell
James Mansour, Lawrence
Samuel Osgood, No. Andover
Edward Seubert, Jr., Lawrence
Allen Stackpole, Lowell

Show Card Design—2 Years.

erald James King, Lowell
dward Francis Mullen, Lowell
aul Philip Pereira, Lowell
Donor Joseph Roy, Lowell
Edward Anthony Silva, Lowell

Decorative Art—3 Years.

Louis Alphonse Allard, Lowell
Eben Tappen Fox, Dracut
Joseph Roland Gauthier, Lowell
Alexandria Ann Koroski, Lowell
Albert Stanislas Landry, Lowell
Emil Peter Pacula, Lowell
Ernest George Pratt, Lowell
Stella Sampatacacus, Lowell

Cotton Weaving—1 Year.

Simonne Desrochers, Lowell
Walter Stanley Dziegiel, Lowell
David Edward England, Lowell
Samuel Royce McMaster, Lowell
Joseph Amy Martin, Lowell
Paul Wilfrid Roy, Lowell
Stanley John Wisniewski, Lowell

Woolen and Worsted Weaving—1 Year.

Albert Louis Beaulieu, Lowell
John Warren Bode, Lawrence
John Augustine Delaney, Lawrence
Gertrude Odile Drouin, Lowell
Existe Joseph Duhamel, Lowell
Louis Charles Duhamel, Lowell
Edward Joseph Dziadosz, Lawrence
Joseph Henry Forget, Lowell
Edward Chester Girard, No. Andover
Clarence Hill, Lawrence
Leo Labelle, Lawrence
Gabrielle Eugenie Lagassé, Lowell
Rosaire Arthur Joseph Marcotte, Lowell
Joseph Amy Martin, Lowell
Rene Moreau, Lawrence
John Nauiokas, Methuen
Samuel Naylor, Methuen
George Aloysius O'Brien, Lawrence
Leonel Sylvio Peloquin, Lowell
James Woodbury Scribner, Manchester, N. H.
Noble Wright, Lawrence

Loom Fixing—1 Year.

Robert Benson, Methuen
Herbert Francis Donaghey, Andover
Richard Arthur Fraser, Manchester, N. H.
Charles Joseph Gibadlo, Lowell
Edwin Ernest Johnson, Lawrence
Edward Baxter Kirwin, Andover
John Joseph Molda, Lowell
Leo Francis Montbleau, Lowell
Wilbur Woodrow Pearson, Methuen
Anthony Leite Pereira, Lowell
Joseph Anthony Stewart, Lowell
Romeo Joseph Touzin, Lowell
John Joseph Walsh, Jr., Maynard

Woolen and Worsted Finishing—1 Year.

Arthur Robert Clinton, Lawrence
Nunzio D'Innocenzo, Chestnut Hill
William Arthur Drummond, No. Andover
Robert Ernest Fraser, Beverly
Maurice Greenfield, Lowell
Albert Edwin Greenwood, Lawrence
Albin John Jozak, Methuen
Augustine Xavier Keleher, Lawrence
John Alexander McKay, No. Billerica
Donald Raymond Neil, Lowell
Walter Holden Perry, No. Andover
Hubert Vincent Raymond, Graniteville
Charles Henry Redman, Lowell
Eldon Stowell, Lowell
John Norman Ward, No. Chelmsford

Remedial English and Rhetoric—1 Year.

Sarah Berg, Lowell
Nelson Whitfield Black, Jr., Nashua, N. H.
Warren Alfred Caster, Lowell
Helena Joan Fish, Lowell
Sophie Foster, Lowell
Louise Elizabeth Frazee, Lowell
Paul Francis Gennell, Lowell
Edna Mae Gordon, Lowell
Lauretta Marie Guilbeault, Lowell
Queenie Alice Harpoot, Lowell
William Andrew Jaracz, Lowell
Ourania Kelakos, Lowell
Caroline Frances Kus, Lowell
Edmond Francis Leavitt, Lowell
Eleanor Mary Loftus, Lowell
Alice May Lomax, Lowell
Alice Marie O'Brien, Lowell
Agnes Gertrude Quinn, Lowell
Gerald Francis Riley, Lowell
Ann Barbara Riordan, Lowell
Warren Paul Riordan, Jr., Lowell
Frank Joseph Rochette, Lowell
Marguerite St. Onge, Lowell
Georgia Savas, Lowell
Margaret Patricia Sheedy, Lowell
Thomas Francis Sheehan, Lowell
Mary Marguerite Sherry, Lowell
Shirley Knowlton Small, Lowell
James Arnold Smith, Lowell
Anna Sophie Sudol, Lowell
Helen Valarie Sudol, Lowell
Jane Patricia Sudol, Lowell
Mary Rita Sweeney, Lowell
Jane Therese Wozniak, Lowell

Appreciation of Literature—1 Year.

laire Cayer, Lowell
elena Patricia Corkran, Lowell
ohn Francis Gleason, Jr., Lowell
auretta Marie Guilbeault, Lowell
thel Viola Hawkins, Methuen
ene Hawkins, Methuen
lary Etta Heath, Lowell
Helen Evelyn Hurwitch, Lowell
William Andrew Jaracz, Lowell
Annette Vivianne Leblanc, Lowell
J. Maurice Naparstek, Lowell
Albert Shamas, Lowell
Mary Agnes Talty, No. Chelmsford

Analytical Chemistry—3 Years.

lfred John Demers, Lawrence
hilip Demetri Evangelos, No. Andover
'arren Franklyn Halstead, Methuen
aymond Lucien Hebert, Lawrence
Howard Cecil Richardson, No. Andover
James Francis Rourke, Lowell
Bernard Francis Tracy, Lowell

Textile Chemistry and Dyeing—3 Years.

anley Wendell Brown, No. Andover
red Arthur Buthmann, Lawrence
ames Edward Cummings, Lowell
uy Sargent Haynes, Haverhill
hannon Mooradian, Haverhill
George William Murray, Lowell
Carleton Prescott, Lawrence
Thomas Joseph Scanlon, Lawrence
Albert Lester Sugden, Methuen
George Edward Stubbs, Lowell

Elementary Chemistry—2 Years.

ohn Edward Atkinson, Methuen
obert Everett Bagshaw, Lowell
lbert Emile Bergeron, Plaistow, N. H.
enry Ramsdell Borchers, Salem Depot, N. H.
eorge McDonald Cochrane, Peabody
lmer Collier, Chelsea
ohn Charles Collins, Lawrence
ilbert James Favro, Lowell
ichard Philip Gelineau, Lawrence
enry Arthur Gutterman, Dorchester
homas Hadfield, Methuen
lifford Arthur Harvey, Lowell
ernon Arthur Larrabee, Lynnfield Center
harles Thomas McInerney, Lowell
Robert Ernest Oates, Lowell
Russell Clarence Nelson, Lowell
Wilbur Joseph Peterson, Peabody
Ralph Maurice Phelps, Jr., Haverhill
Sylvio Arthur Pilato, Lowell
Ralph Stanton Pushor, Lowell
Francis Joseph Quealy, Lowell
Lionel Henry St. Pierre, Haverhill
Robert Shepard, Nashua, N. H.
Harold Francis Smith, Carlisle
Barron Burbridge Tenney, Haverhill
Walter Herbert Wahlen, Cambridge
Joseph Batty Wilkinson, Methuen
James Francis Ward, Peabody

Mechanical Drawing—3 Years.

harles John Hondras, Lowell
illiam Paul Kotarba, Lowell
illiam Lawrence Peterson, Lowell
Philip Archibald Scott, Jr., Billerica
Joseph Kazimir Strelcin, Lawrence

Alternating Current Electricity—2 Years.

hn Barratt Ashton, Lowell
eslie William Cate, Lawrence
oward Coldwell Jones, Methuen
hn Alexander Kasinskas, Lowell
Edward Francis Moran, Lowell
Roger Barton Oliver, Lowell
Frank Joseph Shore, Lowell

Direct Current Electricity—2 Years.

eorge Gallagher Britton, Nashua, N. H.
ed Thurlow Goodwin, Jr., Hudson, N. H.
ouis Joseph Greaves, Lowell
seph Peter Miazga, Lowell
aymond Nabrezny, Lowell
elvin Wilbur Newton, Lowell
anley Joseph Panek, Lowell
Ernest Leroy Partington, Methuen
Herbert Hodgson Robinson, Ayer
Robert Everett Sudsbury, Hudson, N. H.
Earl Winfield Thompson, Manchester, N. H.
Edward Stanley Torla, Lawrence
Howard Richard Usher, Lowell
Stanley Joseph Walek, Lawrence

Steam—1 Year.

William John Fulton, Lowell
Edward Charles Noble, Lowell
Lovis Maurice Saltsman, Lowell
Frederick Skaff, Lawrence
William Asa Todd, Lawrence
Charles Bernard Wilson, Methuen

Machine Shop Practice—2 Years.

Frederick Edward Allatt, Methuen
Paul Emile Bolduc, Lowell
Thomas Clark, Jr., No. Andover
David Joseph Frediani, Lowell
Wyatt Oscar Ingalls, No. Reading
Leslie Frank Kannheiser, Lawrence
Stanley Kohanek, Lowell
John Anthony Lamanna, Nashua, N. H.
Carl Einer Lundstedt, Lowell
Stanley Vincent Maliszewski, Lowell
Norman George Melendy, Lowell
Richard Wingate Morse, Amesbury
Evan Arthur Noyes, Amesbury
Paul Eugene Phelan, Nashua, N. H.
Peter Michael Shoukimas, Lawrence
Robert Albert Simpson, Woburn
Clifton J. Toothaker, Jr., Amesbury
Roland Joseph Toupin, Lowell
Kendall Chapin Tuttle, West Groton
David Francis Valorose, Lowell

Diesel Engines—1 Year

Theodore Cuyler Ackroyd, Jr., Methuen
Raymond Sargent Bennett, Lowell
Edward Paul Boucher, Wamesit
John Leonard Brain, Methuen
William Bruce Cole, Lowell
Alfred Joseph Gordon, Lowell
Paul Kingsley Herbert, Pelham, N. H.
Frank Joseph Kawa, Dracut
Robert John Knapp, Chelmsford
Allen Page McLoon, Lowell
John Edward Newcomb, Lawrence
William Vincent Suslavich, Methuen
James Constantine Vurgaropulos, Lowell
John Constantine Vurgaropulos, Lowell

Mathematics—2 Years.

Veronica Catherine Brosnan, Lowell
John Henry Burris, Billerica
Francis Joseph Cassidy, Jr., Lowell
Alfred Joseph Croisetiere, Lowell
Charles Russell Dudevoir, Forge Village
Eli Forsley, Lowell
John Stanley Fowler, Billerica
Thomas Joseph Furtado, Lowell
Charles John Hondras, Lowell
Arthur Nicholas Koulias, Lowell
Henry Wilbrod Lemire, Lowell
Joan Malapan, Lowell
Nicholas Jonathan Matson, Lowell
Octave Abraham Montminy, Lowell
George Andrew Natsios, Lowell
Martial Bernard Racette, Lowell
Ronald Francis St. Cyr, Lowell
Charles Hollis Snell, No. Billerica
Charles George Tsigaridas, Lowell

Shop Mathematics—1 Year.

John Joseph Behan, No. Billerica
John Bozedragis, Lowell
Robert William Foisy, Lowell
William Russel Healy, Westford
John Steve Manolakis, Lowell
Walter Joseph Molda, Lowell
Edward Felix Padonevitch, Lowell
Raymond Paul Paquin, Lowell
Wyatt Carlisle Sawyer, Lowell
Adam Balis Tatarunis, No. Andover
Edward Richard Thibault, Lowell

Selling and Advertising—1 Year.

John Burton Austin, Reading
James Edward Barrett, Lowell
Albert Joseph Boisvert, Lowell
John Christopher Carroll, Lowell
Anna Frances Casey, Lowell
Joseph Raymond Walter Dufresne, Lowell
Alton Balkcum Duxbury, Lowell
Horace William Duxbury, Lowell
Grace Angelene Greene, Lowell
Frank John Heidenrich, No. Billerica
Karl Louis Heidenrich, No. Billerica
Tessie Mary Kijanka, Lowell
Terrence Stanley Kinnal, Chelmsford
Vincent William Kulick, Jr., Lowell
Albert Wilfred LeBlanc, Lowell
George Edwin McMahon, Lowell
Emanuel Stamatios Manolaras, Lowell
Thomas Bernard Murray, Lawrence
Deme Patsourakos, Lowell
Robert Edward Picken, No. Chelmsford
Olga Helen Piekarski, Lowell
James Orville Robinson, No. Chelmsford
Victor Edmund Romanowski, Lowell
John Joseph Ryan, Andover
Leon Paul St. Lawrence, Lowell
John Joseph Scanlon, Lowell
James Arnold Smith, Lowell
Chris Stavropulos, Lowell
Irene Lillian Symaszek, Lowell
Adam Andrew Wajda, Lowell
Bryce Henry Wilson, Methuen

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THE TEXTILE ENGINEER'S PLACE TOMORROW

Commencement Address
Lowell Textile Institute
June 6, 1939

BY DR. FREDERICK M. FEIKER,
Secretary of the American Engineering Council

In accepting President Eames' invitation to make this Commencement address, I want to acknowledge not only my appreciation for the privilege and the honor which you have paid me, but also my feeling of responsibility. Thirty-five years ago next week I sat facing the Commencement speaker at another Massachusetts College, The Worcester Polytechnic Institute, and I have been trying to remember whether anything he said still lingers in my mind. As a matter of fact, I have been unable to remember either the name of the speaker or anything he said. It may be the reason for this was that a girl was waiting for me after the Commencement exercises were concluded, and my mind was on other matters. Or, it may be that with the enthusiasm of youth I felt that the speaker, being considerably older than I was, really had little to tell me which I did not know myself. In any case, you can understand that I am approaching this opportunity to speak to you this morning with some misgivings. If I am to bring you a message, I must find some way to put my experience in terms of ideas and ideals which we share in common, whether we are on the sunny side or the shady side of fifty.

I suppose the word "Commencement" is chosen as a name for what may seem to you the end of four years of work rather than the beginning, because graduation from an educational institution is for most of us the commencement of our education in living, and not the end. You will understand this, I am sure, when you think of the other Commencements which all of you have undoubtedly attended. From grade schools you were graduated at an earlier Commencement to high school, and with a little more ceremony at the end of high school, again you were graduated at a Commencement and began your work here at Lowell Textile Institute. None of these Commencements however, had the significance of this one today. Today, you are graduating not into another educational institution, but into the business of living and this business of living is from some points of view much harder—from some points of view, much more fun—than anything you have undertaken up to the present time. For most of you no doubt, at each of the other Commencements your fathers and mothers have continued to be your source of income. Beginning shortly, you are no longer, I hope, on their payroll, but on industry's. Up to this time they have watched you and applauded you and helped you over the times that seemed to you difficult. Their affection has overlooked any shortcomings that you may have had. Soon you will be measured by a new set of standards. Your professors who—believe it or not—have wanted you to reach this stage at this Institution, your parents, who have seen this day coming with pride, now expect you to stand on your own feet and to go forward in your chosen occupation.

Some of you in this graduating class are destined to be leaders in your chosen work. I have made no personal analysis of this class and I am not speaking about any individuals, but on the law of averages alone a small percentage of this graduating class of 1939 will do better than the large percentage. The determination of which percentage you fall into, beginning today, is in part in your hands, in part in the hands of the industry in which you are entering, and in part in the destiny of our country and of the world.

Whatever I may tell you this morning arises out of my own experience and observations, since that Commencement Day which I have forgotten so much about. The share that you have in your own success I put first, not alone because in my own experience and observations, personality seems so important, but because of the three elements which I have outlined, for success you at least can control your own share. In your chosen industry you may share

the responsibility for its success with thousands of others and in the world you share that responsibility with millions, but the part you play yourself, is your own. Each of us at times is two persons—one the individual whom our particular public or our associates or our friends know; the second, the one we know ourselves. Sometimes we can fool the people around us but we never can fool ourselves and success and happiness come in my observation, not because of the measure that some outsider has put upon us but because of our own peace of mind. Many men in their own way are happy and successful in what others may think of as minor capacities because they have satisfied themselves that they have done the best they could. Others are extremely unhappy because no matter how successful they have been in the public eye, within themselves they have measured some failure.

My first thought then, as to the share each of us may take in our own success is not to fool ourselves. The qualities of character, which we associate with personality, play a great part in the lives of men. As engineers, we sometimes discount these characteristics, believing that hard work and ability and factual knowledge will win our case, but as the world is constituted, emotion is far stronger than logic at times and many a problem that we, as engineers, would like to see settled on a basis of logic and fact, tends to get settled on the basis of emotion. We, who are trained as engineers, need to remember that getting along with people may be 80% of a job in which 20% is knowledge and ability. As you get out in the world, you will discover that you are dealing not alone with the strength of materials, but with the weaknesses of men.

My work has fallen into lines which have given me the opportunity to know rather intimately hundreds of individuals. For many years I kept a book containing the names, addresses and specialized qualities of men I had met who appealed to me as having something in common with me in getting my work done. There are nearly a thousand names in that book and I suppose that excepting the common qualities of character and common honesty and sincerity of purpose, two qualities are evident in all these men. In the first place, they have exact knowledge growing out of their education and experience, and in the second place—but perhaps more evident—they have the ability to make men understand what they are talking about, which makes their ideas acceptable. Another way to say this is that getting along with your fellow men is just as important as knowledge. When you take your first job, you will discover it essential to get along with your boss and when you become executives, you will still find the same quality essential only you will be getting along with employees. Successful living, in other words, is a constant interplay of human relations in which ability is interpreted in the other man's mind as respect for your knowledge, belief in your sincerity and enthusiasm for your ideals. Fortunate is the man who finds his first boss that kind of a man, and fortunate is the executive who finds in his employees that kind of people.

Each of us may differ in personality and each of you will recognize this fact. But you have also, as a part of your personal equipment and your personal share in success, a common asset which is the specialized education you have secured in this Institution. You begin at least with one advantage not given to those who graduate in more general fields. You have an industry in which to try your wings. In the Commencement addresses that have already been given this year, I note two or three speakers have made the point that specialized education, as distinct from general education, is the need of the day. Lowell Textile Institute has given you that specialized education and you have a right to be proud of Lowell Textile Institute and what it has given you, for Lowell belongs in that class of educational institutions which are labeled as scientific or engineering educational training schools. Moreover, Lowell Textile Institute has taken that kind of thinking one step further and applied it to a specialized industry—the textile business.

Because you are products of this Institution, you are entering this industry with a particular background, not only of specialized education but of a

specialized institution. At the risk of reviewing some facts with which you are already acquainted, may I make this point clearer by briefly summarizing the unique educational system which has been developed in the textile industry. It may not be generally known that there is no other industry in which there are a group of educational institutions serving the needs of training men for that specific industry. It was my good fortune some five years ago, under the auspices of The Textile Foundation, to have the opportunity to visit the eleven educational institutions which have for their object, training of men for the textile industry, to discuss the training of textile men with scores of mill executives and graduates and to form some opinion as to the relation of especially educated and trained men to the advance of the textile art. As most of you know, the first school to provide instruction in textile education was established in Philadelphia in 1884.

Lowell Textile Institute was the second and has been a pioneer in the educational program for the industry. When James Smith, Secretary of the Lowell Board of Trade and promoter of the textile arts, proposed the establishment of a textile school something over forty years ago, I am sure even he with his imagination and enthusiasm could not have visualized the chain of events which he and others who followed him projected, in establishing centers of training for men in the textile industry, not only in Massachusetts, but in North and South Carolina, Georgia, Alabama and Texas.

My reason for relating these historical facts however, is not simply to record that Lowell Textile Institute was the second textile institution to be established in the United States, but rather to say that it was the first to develop courses of instruction in textile engineering based on the engineering concept of education. You, who are graduating today, therefore, are launched from an Institution which has emphasized the value of science and engineering in finding ways and means to solve the problems of a great industry.

There are many indications of the potential value of this training in the trends in textile manufacturing today. It is difficult to appraise the reasons for men's success. But in making the Report on "Training Men for the Textile Industry" for The Textile Foundation, to which I have referred, I was led to put down four characteristics which apparently enable men to be successful in conducting modern textile enterprises. These men had something of the scientist's viewpoint in believing their opinions would be based on fact and analytical inquiry rather than on tradition or rule-of-thumb; they were operating or management-minded in the sense that they saw management a matter of organization of men and equipment rather than simply of financial ownership; they were sales-minded in that they visualized the customers' needs as a basis for their manufacturing quotas; and finally, and perhaps more important, they were design and style-minded because they had not forgotten that the textile business is an art, and that quality and pattern and the other intangibles we call style are often more important than price in the final determination of a successful business.

I would not want to say that leaders of the textile industry combine all these qualities but the successful men I have met in the field have something of each. During the course of the inquiry I talked with the heads of several chemically-controlled divisions of the textile industry, whose primary training was in textile chemistry and research. And even here, the success which they had secured in their departments came not alone because of their scientific knowledge but because they could make their ideas plain to other men, which is a characteristic I have called "sales-mindedness."

Similarly, in the field of plant management, the textile industry has in the past few years drawn to itself many men who are interested not in the rule-of-thumb methods of handling men but in that finer art of management, which adds to an intimate knowledge of the technical side of the works-management job, an accurate judgment of human values.

In the beginning I said that success depended first, on yourself, second, on your industry, and third, on world conditions. So far I have outlined my observations on the part personality and education play and the opportunities which your particular kind of education seems to open up in your chosen

industry. You have been trained in an engineering school, you have been urged to think for yourself, to base your conclusions on facts. In short, you have received as a part of your personal equipment, the beginnings of an education for entering a great business. You will not be expected to make over the business in which you get your first job, but if you have the ability and good fortune to find a way in which to do that job better and can find a way to show your boss how you think it can be done for his advantage, as well as yours, you will have taken the first step up the ladder of leadership.

I have said that your opportunity for success is, in the second place, in the hands of the industry you are about to enter. I think you are fortunate in your choice of industry. True, it has today, its share of problems. It has greed and selfishness and short-sightedness, to overcome just as have all industries and all men. But I have been impressed by the high type of men who have been the leaders of the textile industry. Those who are critical at times of the slowness of our older industries to adopt new methods, overlook the values in tradition and craftsmanship which underly these great service industries. Many of the trade-marked products of earlier years are still the standards of real value as to price and quality when much lip service has been given in other industries to scientific standards. You have a right to be proud of the fine traditions of your chosen industry.

The textile industry is a far flung industry. It is concerned not only with two of the three requirements of civilized living—shelter and clothing (of which food is the third)—but with many of the refinements and luxuries of life, which we have come to accept as a basis of the high standard of living in the United States. The textile industry extends far back into the history of man. And today, to the historic arts of spinning and weaving and dyeing the natural fibres, are added a lengthening of chemically-produced fibres, so that we unite in the production and preparation of textiles not only the earlier arts of civilization, but the later developments in the sciences of physics and chemistry. The primitive historic manufacturing processes of spinning and weaving are today still essential elements in the production of textiles. Yet, whole systems of manufacture and of changing processes have come in these years and textile manufacturing in its scores of branches includes the invention and design of new machinery, the application of electric power, the coordination of thousands of spindles and hundreds of looms into a production unit, with all the details of power production, power application, the management and maintenance of machinery and of huge buildings, and of that immensely significant problem of today, the handling of men.

Again, remark the size of industry and its complexities in the field of distribution and sales. Once a home where the manufacturing establishment and the customer were all under the same roof, today, the customers of a single mill spread around the world. The products of the field, the laboratory, the loom and factory are distributed through scores of channels into a complex mechanism of business with products as diverse as cotton belts and wiping rags for industrial use to fabrics of variety of style and color that overwhelm the imagination. Here is an industry in which beauty and utility join hands for public approval, where that fascinating and capricious element of style may be the reason for one year's success and the next year's failure.

There is a second reason for having pride in your chosen industry and, in spite of temporary setbacks, to have faith in its future, and that is the new approach which many sections of the industry are taking to old problems. To the values of the past with its fine traditions of quality and craftsmanship are being added the values of the scientific method in the invention and perfection of raw fibers, in the improvement of machinery and plant to perform the American miracle of reducing unit costs and increasing wages, in all a pattern of industrial development as interesting and colorful as textile fabrics themselves.

You therefore, are graduating at a time when the spirit of inquiry and of scientific research is pervading both the field of technical production and the field of sales and distribution.

Recently, I participated with representatives of technical research and representatives of business research in a series of conferences on textile mill management in the South, held under the auspices of the Textile Foundation. The leader of the discussion on technical research, Dr. Warren E. Emley of the National Bureau of Standards, put one phase of this spirit of inquiry like this:

"The fabrics our grandmothers wore, in the days when houses were heated by fireplaces, before the open buggy had been discarded for the heated closed car, and before the advent of drycleaning, would not be saleable today. Changing conditions require new kinds of fabrics for both clothing and industrial uses.

"Fabrics are like all other articles in that their properties are dependent upon three factors: raw materials, design, and workmanship. The textile schools have as a major purpose the teaching of good workmanship. The schools and the mills are continuously experimenting with variations in design. But attempts to change the properties of the raw materials have been desultory and largely unsuccessful, probably because we know so little about their fundamental nature.

"Materials in their natural state are seldom satisfactory for man's use. We must boil off our silk, degrease our wool, gin our cotton, before making use of them. Perhaps some additional process would make these fibres still more useful.

"Of course American ingenuity is capable of developing some way of improving the quality of a fibre without much knowledge of the reasons back of the improvement. But it is surer and more logical to learn all we can first about the nature of the fibre; then methods for improving it can be intelligently planned.

"We have been using wool since the dawn of history, yet the chemical and physical makeup of a wool fibre is so complex that we do not yet know what wool really is. We know that raw silk contains two components, but we do not know what they are nor how they are put together. A controversy is now raging between two different schools of thought about the composition of cotton.

"It is just as important for the textile industry to know the fundamental properties of its raw materials as it is for the artist to know his pigments. With this knowledge plus continued developments in the fields of design and workmanship, the textile industry will be able to keep up with the changing demands of an ever-increasing standard of living, or even take the leadership in raising that standard."

At the same conference, research into sales problems was presented by Dr. George Taylor of the University of Pennsylvania. He emphasized the scientific approach to the study of business problems. "Essentially," he said, "Economic or business research involves first, getting the facts about situations outside the individual plant that vitally concern its operations; and second, appraising the significance of such facts. Dr. Taylor expressed a wholesome regard for what he called the "business man's hunch," which he said was often not a capricious or snap judgment, but the result of an appraisal of a host of impressions gotten first-hand, but he went on to say there are situations outside an individual business which call for the collection of statistics, which indicate shifts in market, changes in consumer demand and a study of inventories. He said a major job ahead for business research is to analyze changes in supply and demand and assist adjustment to such changes and the end object is to assist intelligent competition.

I point to both the fields of technical research and the fields of business research in the textile industry as offering opportunities for young men trained in the industry and as further evidence of the growing interest of the textile industry in finding new ways to answer old problems.

Within the month I have seen a specific illustration of what I mean—a textile manufacturing plant with what I may call a "laboratory" at each end.

In this business there is a testing and chemical and physical research laboratory employing a number of textile school graduates interested not only in the chemistry and dyeing, but in the physical and chemical properties of various types of fibers. Both natural and artificial fibres are studied with the idea of putting these fibres together to turn out new and interesting products. At the other end of the plant is what might be called a "market research" laboratory, where again a group of trained men are analyzing the markets, looking ahead to styles and variety in the field of this particular mill, setting up designs, which will appeal to these markets, taking these products back to the research laboratory to discover how they will work in sample lots, then devising improvements or adjustments in the manufacturing process in order to turn out these designs at a profit. These efforts indicate again an opportunity for men with your kind of thinking. You may not expect to undertake these problems at once but you may be sure that if you are alive to what is going on, sooner or later you may make your contribution to the solution of them.

Success, I have said, depends on personality and education, on the characteristics of the industry and on the conditions of the world. Is the world quite as helpless and hopeless as it looks? I try not to think so. There are times when it would seem that the world is going backward, and not forward. In a recent cartoon a series of illustrations showed first, the caveman in his primitive home, next a savage with his house built of sticks, then a house of the Victorian era with a man and wife pridefully viewing it, next the modernistic home, then a little picture labeled "War," and lastly, a man and woman in a cave with gas masks. Such is the picture that the news of today emphasizes.

Truly, we are living in a confused world. But confusing as are the times, some of the issues are becoming clarified and you will be finding your place in a great industry, at a fascinating, if difficult time. Coming, as I do from Washington, the seat of our national government, and from an agency, the American Engineering Council, for the cooperative handling of public problems in which all engineers share, I know something at first hand of the public relations between government and industry of which we read and hear so much. The textile industry shares with all business the task of charting its relations with the consumer, with labor and with the government that seeks to serve us all for the common good.

The terms, "radical," "liberal," and "conservative" are still mixed. No clear-cut picture yet emerges as to whether national policies shall be radical, in the sense that the profit motive shall be eliminated from business; whether they shall be liberal, in the sense that the profit motive must be subordinated to social progress, or whether they shall be conservative, in the sense that the profit motive and social progress are unrelated.

Never before in the history of the United States has national government policy been injected so rapidly into individual business policy. Questions which seemed academic ten years ago in the minds of the individual business man have, by government action, become the guides in determining wages, prices and costs. By abrogating the restrictions against combining inherent in the Sherman Anti-Trust Laws, and by establishing collective bargaining as a principle in dealing with labor on wage policies the Government has permitted trade associations to secure action that was before never legally permitted on group problems. Under the various alphabetical boards and authorities earlier restraints are temporarily abandoned.

In spite of the apparent increase in certain lines of business, in spite of a renewed faith in the future of business, there is still deep unrest among business men, large and small, as to what is to happen in the future with regard to the interrelations between Government and business. Under the impelling publicity of one group of philosophers in Washington, it looks at times as though the factory and industrial system which has been built up in the United States, the progress that has been made in invention and in technical accomplishment and the machinery of trade that has been established under the capitalistic system, are to be overthrown and for them substituted an idealistic philosophy of pure socialism. On the other hand, there have been

times when it has seemed that business, badly led and with dramatic examples of common dishonesty, was doing its utmost to bring about the collapse of the complex structure which has been raised in 150 years.

What is the answer to these conflicts? On what foundations may we build the future? In what may we trust, in the turmoil of ideas that are projected?

You and I may face the future with confidence if we still have faith in the deeper purposes of the American people and if we can, out of the debate and arguments, and out of the specific actions of individuals, and out of proposals and counter-proposals, match all this undigested thought against a clear pattern of purpose.

When I was visiting the textile department of Texas Tech in Lubbock, Texas, I saw a great plateau extending three-quarters of a mile high, three hundred miles in every direction, without a tree, or mountain, or rock to mark the way, in West Texas. In early geography days it was called the "staked plains" because the Indians unable on a sunless day to tell the direction, marked all their trails with stakes in order to cross this immense territory without getting lost.

In the last hundred and fifty years the American people have set up "stakes" which enable old and new trails to be marked without confusion, so we may not lose them, and these markers are as important in laying trails through business and industrial wastes as through the western plains.

The first stake may be labeled a love of justice. Much of the present turmoil and the rush to law to prevent and change things comes from a deep sense of injustice. No temporary panacea that in itself creates new injustices will be accepted by the American people as a final policy for the United States.

As deeply rooted as the love of justice is the desire in America for an equal opportunity for all. This does not mean that all are capable of taking advantage of equal opportunities, but it does mean that the American people as a whole believe the road should be open to the top for the man who has ability and capacity to create and to produce. No governmental proposal that puts a gate across this pathway of opportunity will ever persist in America. Temporary obstructions may be raised, but as soon as it is apparent that the proposal is an obstruction it will just as surely be torn down.

An intolerance of special privileges is a third marker upon the trail of national policy, be it in politics or business. The American people as a whole for a short time, or occasionally for what seems to be a long period, will "stand for" special privileges, but sooner or later that intolerance of special privileges which is imbedded in the core of true Americanism will have its way and we then vote out of office political machines overweighted with graft, or industrial machinery which supports itself on monopolistic privilege.

And finally, there is in America, as every sales manager knows, as every business man knows who has been responsible for the growth of his own business, as every great leader of any movement knows, a crusading idealism that will not be downed in spite of adversity. We do not, in this country, fumble our way through problems, we leap over some of them with qualities of heart rather than qualities of mind. A Rhodes Scholar, visiting this country making a comparison of colonial policies, as he called them, of the nations, said, "America's policy is a policy of altruism, fundamentally. She always relates herself to another nation by establishing health, schools and roads as the basis for that nation's development." This, said he, is a policy of altruism.

On these deeper purposes of the American people, men who seek the way out of our present thinking may base their faith for the future. There are signs of improvement—material improvement—in business. On the other hand there are signs that some of this improvement has been gained by forgetting the fundamental principles that create a solidarity in American thinking. If we will not poison the wells of fact so that all sides of a question can be illuminated before the nation, and if we believe fundamentally that these four statements are at least a part of the deeper purposes of the American people, no man need fear the future.

So, to you men of the class of 1939, I bring a three part message, a belief in the value of the education you have received, a picture of potential opportunities in an awakening industry and a faith in the future of the United States. From the founding of Massachusetts, education has been looked upon as the basis of making a democratic society work. The school and the town meeting were partners in the early development of this great State. Today, a vast educational system for the training of men and women for tomorrow is interwoven in the pattern of the advancing civilization of a nation.

The textile industry has the unique distinction of having recognized this American tool of democracy as a method of meeting the immediate problems and future problems of the industry. This Institution was established not because somebody wanted to have a textile school but because there were major problems in the industry and it was believed that a center of educational training would help to solve those problems. This Institution, as well as all institutions of learning, has its roots in the fundamental truth, namely, that an educated industry is a forward-moving industry, just as an educated democracy is essential to the successful working out of the United States of America. You men, who are graduating therefore, today, are entering an industrial democracy. You are entering a great industry where many earlier graduates of this Institution have taken their place of leadership.

The world needs "How" men. You graduates are a part of the army of "How" men, the engineers of industry. The field of "Why" is the field of the philosopher and the fundamental scientist. The field of "What" is bound up with the emotions and the desires of us all. The field of "How" and you and I who serve it, must find the answer for both.

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IDENTIFICATION OF THE TEXTILE FIBERS*

*John H. Skinkle***

The new fibers which I am going to consider are the ones that are actually new from the standpoint of composition, rather than fibers which vary from already established fibers simply by a difference in physical properties, such as adding crimp to rayon, but which do not essentially change the composition of the fiber. These will include glass fiber, casein wool, mixtures of viscose and casein of the cisalfa type, nylon, and vinyl resin type.

Before we go into the systematic identification, I would like to say a few words about the general chemical properties.

All of these were as we found them, because, being new fibers, they will undoubtedly vary as modifications are made in manufacturing methods.

The glass fibers were insoluble in all the solvents we tested, non-inflammable, and the distinguishing feature which separated them from asbestos was the melting point.

The casein wool had all of the reactions of wool, with the exception of the fact that it was more resistant to alkalis, and therefore the distinguishing reaction is the reaction with cold, strong caustic.

The viscose-casein mixture was distinguished by the fact that it has the color reactions of casein and the solubility reactions of viscose.

Since most of our tests, of course, are preferably of the solubility type so that we may carry them out on dyed fibers, that means that we will have to distinguish it from the viscose.

The nylon had none of the reactions of ordinary fibers, but it is distinguished by the fact that it is soluble in melted phenol and none of the other fibers are soluble in that reagent, with the exception of acetate rayon which however is soluble in acetone while the nylon is not.

The vinyl resin type has none of the ordinary reactions, except that it is soluble in acetone, in which case it is like the acetate rayon, but it is not soluble in glacial acetic acid in which the acetate rayon is soluble.

Microscopically, we find that the glass fiber resembles asbestos, and also, to some extent, cupra. Microscopically, the casein wool resembles both acetate and viscose in that it is more striated than the acetate rayon and less striated than the viscose. It would be, therefore, rather difficult to separate it from either of those fibers.

The cisalfa type—that is, the viscose-casein mixture—resembles viscose.

The nylon looks very much like cupra and in polarized light is very strongly doubly refractive.

The vinyl-resin type has some striations in which it resembles viscose, but it is not doubly refractive. Vinyl-resin, incidentally, shows an extremely high shrinkage the minute it is placed in any hot solution. The shrinkage amounts to seventy-five or eighty per cent. It rolls up into a little ball, so it doesn't give us much trouble.

Now for the chemical separation of all the fibers, including these new fibers. We have boiled down a mass of different tests to eleven which seem to perform fairly satisfactorily. See Table I.

The simplest, of course, is the burning test. We have all seen that used, usually to tell whether there was any wool in the mixture from the odor.

As it happens, I had my sense of smell destroyed some years ago by a laboratory reaction, so that it is of no use to me. In any burning tests I must depend entirely on visual effects.

I divide the results of the burning test into three classes : First, those fibers which do not burn, which include asbestos and glass fibers ; second, those fibers which burn but leave a residue of the same shape and size as the original fiber (that, of course, is weighted silk) ; third, those fibers which burn with or without an odor.

To the first group—those which do not burn—we apply the melting test. The heat of the ordinary Bunsen burner is not sufficient to melt asbestos, but it will melt glass. Consequently, we have two divisions here : Those fibers which melt (which are glass) and those which do not melt (which are asbestos).

*Paper presented at the Annual Meeting of the A. A. T. C. C. in Boston, Mass., Sept. 15, 1939.

**Assistant Professor of Textile Chemistry, Lowell Textile Institute.

The third test is the old five per cent KOH test, applied to those fibers which burn with or without odor. That divides the fibers into two groups: Those which are soluble (hairs, casein wool, and silks) and those which are insoluble (other kinds).

Taking those fibers which are soluble in KOH, we apply the fourth test—cold, concentrated hydrochloric acid. The hairs and casein wool are insoluble.

To separate the hairs and the casein wool, we use the fifth test—twenty per cent sodium hydroxide for three hours at 30° C. The hairs are soluble and the casein wool is insoluble.

The sixth test applied to those fibers which are not soluble in KOH. This is the acetone test. That divides the fibers into two groups: Those which are soluble (acetate and vinyl) and those which are insoluble (other fibers).

The seventh test is the application of cold, glacial acetic acid applied to those fibers which are soluble in acetone. That divides it into two groups: Acetate rayon (soluble) and vinyl-resin (insoluble).

The eighth test is the melted phenol test. We take some crystalline phenol (or carbolic acid) and heat it until it melts, which is at about forty degrees Centigrade, and place the fiber in it. The nylon is soluble and the other fibers are insoluble. Remember that acetate rayon would be soluble, but it has already been determined at this point, so it doesn't interfere with the test.

The ninth test is a color reaction, but it is applicable to a stripped fiber—that is, if the fiber is dyed we can strip the dye and then test with the zinc chloride-iodine solution. This test gives a blue color with mercerized cotton, cupra, viscose, and cisalfa, and no color with cotton, jute, hemp, and flax.

That is as far as we can go on a dyed sample by chemical tests; it is impossible to go any further.

If the fiber is not dyed, however, there are two further tests that may be applied. The fibers which give a blue color with the zinc chloride-iodine agent may be tested with Millons agent. Cisalfa gives a red color at this point. The mercerized cotton, cupra, and viscose do not.

The eleventh test is the aniline sulfate test. It may be applied to fibers which are not colored by zinc chloride-iodine, and we find that jute and hemp give a yellow color, whereas cotton, flax, and ramie give no color.

That is as far as we can go chemically. Some of the fibers, acetate rayon etc., may be positively identified. There are, however, left a few groups.

In the first place we have the hairs which cannot be chemically separated, but which must be identified microscopically. We have the silks in one group. Microscopically, of course, their identification is easy. Then in another group we have mercerized cotton, cupra, and viscose. They can be identified, also, microscopically. Finally, we have in the last group, cotton, flax, and ramie, which can be microscopically identified.

Table II gives the detailed directions for preparing the reagents and carrying out the tests.

<table>
<tr><th colspan="13">Table I
Chemical Identification of Fibers</th></tr>
<tr><td colspan="13">Hold Fibers in Flame (1)</td></tr>
<tr><td colspan="2" rowspan="2">Do not burn. ASBESTOS GLASS
Heat in Bunsen flame (2)</td><td rowspan="3">Burn. ash retains shape of fiber
Weighted Silk</td><td colspan="10">Fibers burn or melt to ball
Boil in 5% KOH or NaOH (3)</td></tr>
<tr><td colspan="3">Soluble
Silks, Hairs, Casein
Test with cold, conc. HCL (4)</td><td colspan="7">Insoluble
Test with acetone at room temperature (6)</td></tr>
<tr><td>Melt
GLASS</td><td>Do not melt
ASBESTOS</td><td>Soluble
SILK
TUSSAH</td><td colspan="2">Insoluble
HAIRS, CASEIN
Test with 20% NaOH at 30°C for 3 hours (5)</td><td colspan="2">Soluble
ACETATE
VINYL
Test with cold glacial acetic acid (7)</td><td colspan="5">Insoluble
Test with melted phenol (8)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Soluble
NYLON</td><td colspan="4">Insoluble
Strip dye, test with $ZnCl_2$-I_2 (9)</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Soluble
HAIRS</td><td>Insoluble
CASEIN</td><td>Soluble
ACETATE</td><td>Insoluble
VINYL</td><td></td><td colspan="2">Blue Color
MERCERIZED, CUPRA
VISCOSE, CISALFA</td><td colspan="2">No Color
COTTON, FLAX, JUTE
RAMIE, HEMP.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">If undyed, test with Millon's reagent (10)</td><td colspan="2">If undyed, test with aniline sulfate (11)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Red Color
CISALFA</td><td>No Color
MERC.
CUPRA
VISCOSE</td><td>Yellow Color
JUTE
HEMP</td><td>No Color
COTTON
FLAX
RAMIE</td></tr>
</table>

TABLE II

Reagents and Tests

(1) *Flame test*

Remove several fibers from the sample and hold the ends in the flame of a match.

(2) *Bunsen flame test*

Hold the ends of the fibers in the flame of a Bunsen or Tirrell burner for 15-30 seconds or until the fibers are a bright red color.

(3) *5% KOH or NaOH test*

To prepare the reagent, dissolve 5 grams of potassium hydroxide or sodium hydroxide in water and make it up to 100cc.

Place a small bundle of fibers on a watchglass and add several cubic centimeters of the reagent. Place on wire gauze and heat to boiling, allow the sample to boil for 5-10 minutes.

(4) *Cold concentrated HC1 test*

Use ordinary concentrated hydrochloric acid at room temperature.

Place a small bundle of fibers on a watchglass and add several cubic centimeters of hydrochloric acid. Allow the sample to remain for 5-10 minutes.

(5) *20% NaOH test*

Dissolve 20 grams of sodium hydroxide in 80cc of water.

Heat a beaker of water to 30°C (86°F). Place about 5cc of the reagent in a test tube, add a small bundle of the fibers, and stand the test tube in the beaker of water. Maintain the water at 30°C for 3 hours.

(6) *Acetone test*

Place a few fibers on a watchglass and add several cubic centimeters of acetone at room temperature for 10-15 minutes.

(7) *Glacial acetic acid test*

Place a few fibers on a waterglass and add several cubic centimeters of glacial (100%) acetic acid at room temperature for 10-15 minutes.

(8) *Phenol test*

In a test tube or small beaker, melt enough phenol (carbolic acid) to give about 5cc of liquid. Phenol melts about 40°C (104°F). Caution should be used to prevent spattering and to prevent the phenol from contacting the skin or bad burns may be suffered.

Place a small bundle of the fibers in the melted phenol and allow them to remain 10-15 minutes.

(9) *$ZnCl_2$-I_2 test*

This color test may be used on dyed fibers by stripping the dye off the fibers first.

Solution A: dissolve 280 grams of zinc chloride in 300cc of water.

Solution B: dissolve 20 grams of potassium iodide in 100cc of water and then dissolve 1 gram of iodine.

When ready to make a test, place 20cc of Solution A in a small beaker or test tube and add 0.2cc of Solution B. Place a bundle of the fibers and a small piece of cotton cloth or yarn in the mixture and allow it to stand at room temperature for exactly 3 minutes. If the cotton is still white, observe the color of the unknown, if the cotton is darkened, rinse both the unknown and the cotton together with water until the cotton turns white, then observe the color of the unknown.

(10) *Millon's reagent test*

This test may be applied only to undyed samples.

The reagent is prepared by placing 1cc of metallic mercury in a small beaker, adding 10cc of concentrated nitric acid, and warming if necessary to dissolve the mercury. When the mercury is dissolved, add 10cc of water. This reagent should not be kept for over a month.

A few fibers are placed on a watchglass and several drops of the reagent are added. The watchglass is then heated until boiling begins and the color of the specimen is noted.

(11) *Aniline sulfate test*

Dissolve 2 grams of aniline sulfate in 100cc of water.

A small bundle of fibers is placed on a watchglass and several drops of reagent are added at room temperature. The color of the unknown is observed.

This test also can be used only on undyed samples.

Southwick Hall Louis Pasteur Hall

SERIES 43. NO. 3. February, 1940

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

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1940

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Publication of this Document approved by the Commission on Administration and Finance
6500. 2-'40. D 789.

CALENDAR

1939–1940

September 7–8, Thursday–Friday	Entrance Examinations
September 11–16, Monday–Saturday	Re-examinations
September 14, Thursday, 9.30 A.M.	Registration for Freshmen
September 18, Monday	Registration for upper-class students Classes begin for Freshmen
September 19, Tuesday	Classes begin for upper-class students
October 12, Thursday	Columbus Day — Holiday
November 11, Saturday	Armistice Day — Holiday
November 29, Wednesday, 4.00 P.M.	Thanksgiving recess begins
December 4, Monday, 8.30 A.M.	Thanksgiving recess ends
December 15, Friday, 4.00 P.M.	Christmas recess begins
January 2, Tuesday, 1.25 P.M.	Christmas recess ends
January 15, Monday	First term examinations begin
January 26, Friday	End of first term
January 29, Monday	Second term begins
February 22, Thursday	Washington's Birthday — Holiday
March 21, Thursday, 4.00 P.M.	Spring recess begins
April 1, Monday, 8.30 A.M.	Spring recess ends
April 19, Friday	Patriots' Day — Holiday
May 27, Monday	Second-term examinations begin
May 30,Thursday	Memorial Day — Holiday
June 11, Tuesday	Commencement
June 13–14, Thursday–Friday	Entrance Examinations

1940–1941

September 12–13, Thursday–Friday	Entrance Examinations
September 16–21, Monday–Saturday	Re-examinations
September 19, Thursday, 9.30 A.M.	Registration for Freshmen
September 23, Monday	Registration for upper-class students Classes begin for Freshmen
September 24, Tuesday	Classes begin for upper-class students
October 12, Saturday	Columbus Day — Holiday
November 11, Monday	Armistice Day — Holiday
November 28, Thursday	Thanksgiving Day — Holiday
December 20, Friday, 4.00 P.M.	Christmas recess begins
January 6, Monday, 8.30 A.M.	Christmas recess ends
January 20, Monday	First term examinations begin
January 31, Friday	End of first term
February 3, Monday	Second term begins
February 22, Saturday	Washington's Birthday — Holiday
April 4, Friday, 4.00 P.M.	Spring recess begins
April 14, Monday, 8.30 A.M.	Spring recess ends
April 19, Saturday	Patriots' Day — Holiday
May 26, Monday	Second term examinations begin
May 30, Friday	Memorial Day — Holiday
June 10, Tuesday	Commencement
June 12–13, Thursday–Friday	Entrance Examinations

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HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The courses for those students who can attend the day classes are organized to prepare them to enter some one of the various branches of the textile industry. It is required that all such students shall have an educational background equivalent to that of a complete college preparatory course as given by a recognized high school or academy. These textile courses are either of three or four years duration and are described in detail on the following pages of this catalogue.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three story addition was placed on a single story building that was previously known as the Colonial Avenue Building which was erected in 1910.

This Hall contains on the first floor the Cotton Finishing laboratory with class rooms and offices of the Wool Department. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry and Textile Coloring Department.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will, it is hoped, be further improved to make a modern campus for baseball and other sports.

On the upper floor of the Falmouth Street Building there has been provided a recreation room for the use of the students at such times as their attendance is not required in classes.

In the basement of this building there are rooms for the use of the athletic teams. Connected to these are showers and dressing rooms.

The upper hall of Southwick Hall has been equipped with gymnastic apparatus.

In order to be sure that no student having any dangerous physical weakness takes part in any athletic contest, all candidates for the various athletic teams are obliged to pass a satisfactory physical examination.

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Board or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects

Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry	1
	12

Elective Subjects	Points
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of thirteen points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry	1
	10

Elective Subjects

Four may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 6, 1940; Thursday, September 12, 1940; Thursday, June 12, 1941:—
- Algebra, 9 A.M. to 11 A.M.
- History, 11 A.M. to 1 P.M.
- English, 2 P.M. to 4 P.M.

Friday, June 7, 1940; Friday, September 13, 1940; Friday, June 13, 1941:—
- Plane Geometry, 9 A.M. to 11 A.M.
- German or French, 11 A.M. to 1 P.M.
- Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

Chemistry.—Requirements are those of the New England College Entrance Board, or the Board of Regents of New York, including personal laboratory work. Those not meeting the requirements by school or college certificate will be subject to written examination.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on

Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course. viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of

industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Within the last few years the possibilities for women in certain branches of the textile field have become recognized and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some who choose the Textile Engineering Course with the design option, for it offers a broad training that prepares for many lines of activity. For those who wish to specialize in art and textile designing in their general application, courses will be arranged as far as the facilities of the Institute will permit. Some are interested in textile chemistry and pursue the Chemistry and Textile Coloring Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students are the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course shall be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements. All courses both undergraduate and graduate are open to women.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 19, at 9.30 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 8.30 A.M. to 12.20 P.M., and from 1.25 to 4.00 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations.—For first-year students examinations are held every five

weeks, and these serve to inform the student concerning his standing and the progress made.

For students in upper classes examinations will be held during the eighth week of each term.

Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Thesis.—Each candidate for the degree of the Institute must file with the head of the department in which the thesis is taken, and not later than May 15, a report of original investigation or research, written on a good quality of paper, 8½ by 11 inches, with one-inch margin at left, and one-half inch at right, of each page; such thesis to have been previously approved by the head of the department in which it is made.

For all candidates for the diploma this requirement will be optional on the part of the Institute.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

The Chemistry and Dyeing Department also has a library supplied with books and periodicals which pertain to chemistry in general and textile chemistry and dyeing in particular.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee is $250 per year. The fee for students from foreign countries is $500 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

Lockers, sufficiently capacious to contain clothing, books and tools, are provided for the use of the students.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (foreigners)	500
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee (This applies to students who do not take chemistry or machine shop.)	10
Books and supplies (Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	50

PRIZES

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

First.—Ten dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the highest scholarship in first-year chemistry.

Second.—Five dollars to the student taking the regular Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship in first-year chemistry.

Third.—Ten dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having obtained the highest scholarship during his second year.

Fourth.—Five dollars to the regular student of the Chemistry and Textile Coloring Course who shall be considered as having attained the second highest scholarship during his second year.

Fifth.—Ten dollars to the student graduating from the Chemistry and Textile Coloring Course, who not having already received recognition by appointment as an assistant instructor, shall have maintained the highest scholarship throughout the course, in the opinion of the instructing staff of the department.

The above-mentioned sums are to be invested in books which may be selected after graduation. In case no one is considered worthy of any particular scholarship prize, or if there is no competition, the same may be withheld. The decision in such case shall rest with the judges.

The National Association of Cotton Manufacturers Medal.—The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who, during his course, shall have attained the highest standing in special subjects required by the vote of the association.

The Proprietors of the Locks and Canals on the Merrimack River Scholarship at Massachusetts Institute of Technology. Several years ago the Proprietors of the Locks and Canals on the Merrimack River, a corporation owning the power rights on the Merrimack River in Lowell, gave to the Massachusetts Institute of Technology a sum of money to provide graduate scholarships to graduates from the Lowell Textile Institute who held a degree and were recommended by the trustees. Applicants must have maintained throughout their undergraduate courses a high scholastic record and must meet the requirements of the Graduate School of the Massachusetts Institute of Technology.

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives a theatrical program annually. Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Chapter of the American Association of Textile Chemists and Colorists sponsors meetings addressed by speakers on technical subjects.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store. —A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purehasing from the Book Store and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of tbe association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1939–40

Philip F. O'Brien, '15, *President*
Harold V. Farnsworth, '16, *Vice-President*
Arthur A. Stewart, '00, *Secretary-Treasurer*
A. Edwin Wells, '20, *Assistant Secretary*

Communications should be addressed to Arthur A. Stewart, Lowell Textile Institute.

Executive Committee

Roy H. Bradford, '06
James F. Dewey, '04
Parker F. Dunlap, '34
Charles H. Forsaith, '20
Edwin D. Fowle, '24
Olin D. Gay, '08
Milton Hindle, '25
Robert F. Jessen, '36
Thomas Joy, '26
Francis P. Madden, '13
Kilburn G. Pease, '38
Richard W. Rawlinson, '31
Everett B. Rich, '11
Homer C. Riggs, '17
J. Milton Washburn, Jr., '21

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term
(Common to all Courses)

	Hours of Exercise
Elementary Inorganic Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Inorganic Chemistry C–10	30	30
Elementary Organic Chemistry C–11	45	45
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–12 or C–12a	150	45
Stoichiometry C–13	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 34.

Course I.—Cotton Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	30	Mechanism B–12	60
Elementary Organic Chemistry C–11	45	Physical Education	30
English E–10	45	Qualitative Analysis C–12a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		

Second Year. First Term

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C-20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	75
Power Weaving D–24	150		

Third Year. First Term

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	165
Cotton Yarn Manufacture F–30	135	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

Third Year. Second Term

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	225	Thesis F–34.	
Knitting F–31	105		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence. Instruction in the production and manipulation of re-worked wool is also included.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 34.

Course II.—Wool Manufacture

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	30	Mechanism B–12	60
Elementary Organic Chemistry C–11	45	Physical Education	30
English E–10	45	Qualitative Analysis C–12a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		

Second Year. First Term

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

Second Year. Second Term

Fiber Preparation G–20–21	270	Textile Chemistry and Dyeing Lect. C-20.	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	60
Power Weaving D–24	120		

Third Year. First Term

Electricity B–31a	30	Textile Testing G–31	30
Knitting F–31	105	Woolen and Worsted Finishing H–30	75
Mill Engineering B–34a	30	Worsted Yarn Manufacture G–30	210
Power Weaving D–32	45		

Third Year. Second Term

Power Weaving D–32	195	Worsted Yarn Manufacture G–30	255
Woolen and Worsted Finishing H–30	75	Thesis.	

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The courses of freehand drawing, perspective and color serve as means in applying the instruction received in courses of historic ornament, dynamic symmetry and textile styling to a better understanding of fashion trends and the changing designs that follow these. The actual pattern drafting and making of garments may be extended to a limited extent as time and individual skill permits.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 34.

Course III.—Textile Design

[For first term see page 19]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	30	Mechanism B–12	60
Elementary Organic Chemistry C–11	45	Physical Education	30
English E–10	45	Qualitative Analysis C–12a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		

Second Year. First Term

Cotton Yarn Manufacture F–20a	90	Steam Engineering B–24	30
Color and Dynamic Symmetry D–33	30	Textile Chemistry and Dyeing Lect. C-20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20, 21	210
Power Weaving D–24	90		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G–20–21	90	Textile Design and Cloth Construction D–20, 21	135
Jacquard Design D–23	45		
Physics B–23a	45		
Power Weaving D–24	120		

Third Year. First Term

Cotton Finishing H–31	75	Textile Testing G–31	30
Cotton Yarn Manufacture F-30a	60	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	60	Worsted Yarn Manufacture G–30	90
Textile Design and Cloth Construction D–30	135		

Third Year. Second Term

Cotton Finishing H–31	75	Woolen and Worsted Finishing H–30	75
Cotton Yarn Manufacture F-30a	60	Worsted Yarn Manufacture G–30	60
Jacquard Design D–23	75	Thesis.	
Power Weaving D–32	105		
Textile Design and Cloth Construction D–30	75		

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultra-microscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several elective subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 34.

Course IV.—Chemistry and Textile Coloring

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45	Quantitative Analysis C–23	130
Organic Chemistry II C–22	30	Stoichiometry C–24	15
English E–20	30	Textile Chemistry and Dyeing Lab. C–21	90
Mathematics B–20a	60	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Power Weaving D–24a	15		

Second Year. Second Term

Advanced German E–21	45	Stoichiometry C–24	15
Organic Chemistry II C–22	30	Textile Chemistry and Dyeing Lab. C–21	145
English E–20	30	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Quantitative Analysis C–23	150		

Third Year. First Term

Organic Chemistry III C–34	15	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lab. C–32	135	Quantitative Analysis C–30	150
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Technical German C–35	30
Economics E–30	45	Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	90	Organic Laboratory I C–36	90
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Physical Chemistry C–33	45
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	75	Microscopy and Photomicroscopy C–45	60
Adv. Textile Chemistry and Dyeing Lect. C–44	30	Electives or Thesis C–52	90
Chemical Textile Testing C–43	45	Organic Laboratory II C–41	75
Colloid Chemistry C–50	30	Quantitative Analysis C–46	15
Industrial Chemistry C-42	30	Report Writing C–47	15
		Technical German C–40	30
		Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30	Organic Laboratory II C–41	105
Adv. Textile Chemistry and Dyeing Lab. C–44	120	Rayon Manufacturing C–51	30
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Seminar in Business English E–40	15
Chemical Textile Testing C–43	45	Technical German C–40	30
Electives or Thesis C–52	90	Technology of Wool Manufacture Fibers G–40	15
		Textile Literature C–48	30

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The course is planned so as to provide a foundation in those subjects which are essential to the training of an engineer, coupled with a thorough understanding of textile processes and materials. Such subjects as mathematics, physics, chemistry, drawing, mechanics and mechanism, provide for the first objective. The second is secured by a study of cotton, woolen and worsted yarn manufacturing, textile designing, weaving, knitting, dyeing, and finishing. Instruction is by means of lectures, recitations and laboratory work.

A large proportion of the student's time is spent in well equipped textile departments where he is familiarized with the machinery and processes used in the conversion of cotton and wool fibers into yarns and finished fabrics. The subjects of textile testing and microscopy acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering. Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice. Mill engineering familiarizes the student with factory design, construction, heating, lighting, humidification, fire protection, and the arrangement of machinery and buildings for most efficient production and economical power distribution.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

The Cotton and Wool Options of the Textile Engineering course have been provided for those students who may desire the breadth of technical training which this course offers but who wish to specialize in either cotton or wool manufacturing. In these optional courses the student's entire time is devoted to the study of that particular fiber which he elects. A demand from the distributing and marketing divisions of the textile industry for properly trained men has lead to the establishment of the Sales Option of the Textile Engineering course. This is patterned after the General Course but with more time devoted to such subjects as selling, advertising, marketing, foreign trade and the like. There have also been requests for a four-year degree course in which the design of textile materials should receive the greater emphasis. For this purpose the Design Option of the Textile Engineering course is offered, which, while majoring in textile design, includes other subjects that make a broader course than the one of shorter duration.

In the General Option some recognition is given to those who may wish to lay more emphasis on knit fabrics. This is done by the substitution of knitting laboratory time for a portion of that assigned to weaving laboratory and is dependent on the possibility of arranging for such special cases.

For detailed description of subjects, see page 34. The curricula of the several optional courses will be found on pages 29 to 33.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Fiber Preparation G–20, 21	120	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–22	45
Machine Shop B–26	75		
Mathematics B–20	60		

Second Year. Second Term

Applied Mechanics B–25	45	Mathematics B–20	60
Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Electives F–25		Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Machine Drawing B–21	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	60	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electives F–35		Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Mill Engineering B–34	90
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	90	Textile Microscopy B–41	45
Electrical Engineering B–44	75	Textile Testing B–43	60
Mill Engineering B–45	60	Thesis	75

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31a	30
Cotton Finishing H–31	105	Mill Engineering B–45	75
Electives B–48 or F–45		Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	180	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	90	Textile Design and Cloth Construction D–20	90
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Applied Mechanics B–25	45	Power Weaving D–24	60
Cotton Yarn Manufacture F–20a	135	Textile Chemistry and Dyeing Lect. C-20.	30
Machine Drawing B-21	45	Textile Design and Cloth Construction D–20	75
Mathematics B–20	60		
Physics B–23	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	180	Machine Shop B–26	45
Economics E–30	45	Power Weaving D–32	60
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	180	Heat Engineering B–33	90
Economics E–30	45	Mill Engineering B–34	90
Electrical Engineering B–31	75	Power Weaving D–32	45

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	105	Textile Microscopy B–41	45
Electrical Engineering B–44	75	Textile Testing B–43	60
Mill Engineering B–45	30	Thesis	90

Fourth Year. Second Term

Business Administration B-46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Fiber Preparation G–20, 21	225	Mathematics B–20	60
Machine Drawing B–21	90	Physics B–23	75
Machine Shop B–26	45	Textile Chemistry and Dyeing Lecture C–20	30

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B-21	45	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

Third Year. Second Term

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Electrical Engineering B–44	75	Textile Microscopy B–41	45
Mill Engineering B–45	30	Textile Testing B–43	60
Textile Design and Cloth Construction D–21	75	Thesis	120

Fourth Year. Second Term

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	90
Mathematics B–20	60
Physics B–23	75
Textile Chemistry and Dyeing Lecture C–20	30
Textile Design and Cloth Construction D–20, 21	210

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60
Fiber Preparation G–20, 21	90
Mathematics B–20	60
Physics B–23	75
Knitting F–25	30
Power Weaving D–24	75
Textile Chemistry and Dyeing Lect. C-20	30
Textile Design and Cloth Construction D–20, 21	105

Third Year. First Term

Color D–33	30
Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Knitting F–25	45
Power Weaving D–32	75
Textile Design and Cloth Construction D–30	105
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Color D–33	45
Dynamic Symmetry D–34	30
Cotton Yarn Manufacture F–30a	60
Economics E–30	45
Power Weaving D–32	105
Textile Design and Cloth Construction D–30	75
Worsted Yarn Manufacture G–30	90
Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Accounting B–40	90
Jacquard Design and Weaving D-40	90
Textile Design and Cloth Construction D-41	75
Textile Marketing B–42	30
Textile Microscopy B–41	45
Textile Styling B–50	30
Textile Testing B-43	60
Thesis	105

Fourth Year. Second Term

Business Administration B–46	90
Cotton Finishing H–31	105
Jacquard Design and Weaving D-40	105
Textile Design and Cloth Construction D-41	90
Thesis	135

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 19]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Color D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	75		
Principles of Marketing B–35	45		

Third Year. Second Term

Color D–33	30	Statistics B-53	45
Cotton Yarn Manufacture F–30a	75	Textile Design and Cloth Construction D–30	75
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Marketing Methods B–36	60	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	30		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Principles of Selling and Advertising B–49	105	Textile Styling B–50	30
Selling Policies B–52	45	Textile Testing B–43	60
Jacquard Design and Weaving D–40	45	Thesis	105

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31	75
Cotton Finishing H–31	105	Selling Policies B–52	45
Foreign Trade and Economic Geography B–51	45	Thesis	165

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

LABORATORY. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.]

Mechanical Drawing—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals,

summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B-20a. Preparation: B-10. This subject is a continuation of the work of the first-year subject B-10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B-21. Preparation: B-10, B-12, B-13. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B-23. Preparation: B-10 and B-11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

Laboratory. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B-23a. Preparation: B-10 and B-11. This subject consists of the same topics as B-23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B-24. Preparation: B-12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B-25. Preparation: B-11, B-20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B-26. Preparation: B-11 and B-12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as

possible to commercial machine-shop practice on textile machinery. The list of tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B–30. Preparation: B–25. This is a continuation of Applied Mechanics B–25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B–31. Preparation: B–23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B–31a. Preparation: B–23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B–32. Preparation: B–12, B–20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

Laboratory. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B–33. Preparation: B–32. This course is a continuation of B–32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates. with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

Laboratory. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B-34. Preparation: B-21, B-25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B-34a. Preparation: B-21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B-34. [Courses I, II.]

Principles of Marketing—B-35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B-36. Preparation: B-35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Accounting—B-40. Preparation: B-10 and E-30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Textile Microscopy—B-41. Preparation: B-23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with acccompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B-47. Preparation: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B–48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B–49. Preparation: B–36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B–50. Preparation: D–30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B–51. Preparation: E–30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B–52. Preparation: B–36. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B–53. Preparations: B–20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Inorganic Chemistry—C–10. Preparation: Admission Requirements. During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C–12. [All courses.]

Elementary Organic Chemistry—C–11. Preparation: Admission Requirements. This course, covered by lectures during the second term, includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient

breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C–20. [All courses.]

Qualitative Analysis—C–12. Preparation: C–10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C–10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as mordanted cloths, pigments and the various dyeing reagents. [Course IV.]

Qualitative Analysis—C–12a. Preparation: C–10, taken simultaneously. This course is similar to C–12, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C–13. Preparation: C–10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C–20. Preparation: C–10, C–11, B–12, B–13a. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C-21. Preparation: C-20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

Bleaching processes applicable to various animal and vegetable fibres are studied.

Work in color matching is also carried out on a laboratory scale. A fairly extensive study of the fastness properties of representative dyes of each class is taken up as well as their suitability for various classes of work.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Organic Chemistry II—C-12. Preparation: C-11. The purpose of this course is to lay a broad foundation for the understanding of the basic principles of organic chemistry. The first semester consists of illustrated lectures and recitations covering the aliphatic series. The second term is devoted to the aromatic compounds. A number of problems are assigned as home exercises in order to fix the fundamental principles of the science in the students' mind. Books: J. F. Norris—Principles of Organic Chemistry and E. H. Huntress—Problems in Organic Chemistry. [Course IV.]

Quantitative Analysis—C-23. Preparation: C-12. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Talbot's "Quantitative Chemical Analysis" 1937 Edition is used as a text. [Course IV.]

Stoichiometry—C-24. Preparation: B-10, C-10, C-13. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C-30. Preparation: C-23. The fundamental principles acquired in Course C-23 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. Mahin's Quantitative Analysis, supplemented by "Analytical Methods for a Textile Laboratory" (as printed in the Year Book of the American Association of Textile Chemists and Colorists) is used as a text. [Course IV.]

Industrial Chemistry—Inorganic—Lecture—C-31. Preparation: C-22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's "Industrial Chemistry," Third Edition. Particular attention is paid to the purification of industrial water supplies, the manufacture of heavy chemicals, such as acids, alkalies, bleach liquors, and mordants; the building industry, including the manufacture of Portland cement, glass, iron and steel.

The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C-32. Preparation: C-20, C-21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially

prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Dye House and Finishing Plant Management.—A study of the organization and management of the modern bleacheries, dyehouses and finishing plants.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–13. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Organic Chemistry III—C–34. Preparation: C–22. This course (one semester) is a continuation of Organic Chemistry II extending over the alicyclic and heterocyclic series. The lectures also touch upon certain special topics such as general synthetical methods, theoretical considerations, natural products (vitamins, hormones, chlorophyl, the blood pigments, alkaloids), dyestuffs, etc. ([Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory I—C–36. Preparation: C–20, C–22, C–23. A number of typical organic compounds are synthesized by general methods. A special problem is also assigned to train the student in longer or more difficult syntheses (one semester). Laboratory Book: Gatterman-Wieland—Laboratory Methods of Organic Chemistry. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory II—C–41. Preparation: C–36. The first semester is devoted to the qualitative identification of organic compounds by the Mulliken-Huntress system. The usual quantitative determinations Carius halogen, combustion carbon-hydrogen, molecular weight determinations are taken up in the second half of the year. Laboratory book: Mulliken-Huntress—Identification of Organic Compounds (to appear in print 1940). [Course IV.]

Industrial Chemistry—Organic—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31 and includes the study of the oil, soap, gas, and coal tar industries. [Course IV.]

Chemical Textile Testing—C–43. Preparation: C–21, C–32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Statistical methods, relative humidity, regain, staple, hair weight, fiber resiliency, counts and denier, twist, evenness, cloth count, weight, crimp, thickness, porosity, permeability, waterproofness, wetting out, absorbency, shrinkage, thermal insulating value, handle or draping quality, wear or abrasion, strength and stretch.

Chemical Testing.—Inorganic extraneous matter: ash, ash alkalinity, silk weighting, acids and alkalies. Organic extraneous matter: scouring loss, extraction, sizing and finishing materials. Fiber mixtures: qualitative analysis, quantitative analysis. Swelling and damage in cellulose fibers: qualitative tests, barium activity number, ash alkalinity, solubility in sodium hydroxide, Methylene Blue absorption, copper number, fluidity. Damage to wool: lead acetate test, thiocyanate test, Pauly test, methylene blue test, sulfur content, total nitrogen content, soluble nitrogen, ammonia nitrogen, solubility in dilute alkali. Damage to silk: Zimmermann test, total nitrogen, ammonia nitrogen, viscosity in zinc chloride.

Optical Testing.—Colorimeter, tintometer, pH apparatus, refractometer, spectroscope, spectrophotometer, ultra-violet, infra-red, luster. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–44. Preparation: C–32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C–45. Preparation: B–23, C–20, C–22. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon.

The lectures also include the subject of photomicroscopy. The laboratory course may be selected by the student as an optional course. [Course IV.]

Quantitative Analysis—C–46. Preparation: C–30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C–47. Preparation: B–20a, E–20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

Textile Literature—C–48. Preparation: C–47. This object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

Advanced General Chemistry—C–49. Preparation: C–10, C–12, C–24, C–34, C–42, C–46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Colloid Chemistry—C–50. Preparation: C–33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Adsorption, surface tension and wetting-out, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of irreversible emulsoids, protective colloids and detergents, gels, amorphous solids, use of X-rays, properties of proteins.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, paper, cellulose esters and lacquers, rayons, silk, wool, silk weighting, mordanting, dyeing, felting of wool. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C–51. Preparation: C–32. During the past five years the developments of the bleaching, dyeing and finishing of rayon have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Elective Subjects or Thesis during fourth year—C–52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take elective work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931-32 several electives were introduced, each elective period being 45 hours per term and four of these being required during the year.

Thesis. If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more elective periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or elective subjects, will be required for graduation.

Photography. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

Photomicroscopy Laboratory. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both fibers and fabrics. Students taking this elective should have had Photography or the equivalent in experience.

Advanced Microscopy. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

Colloid Chemistry Laboratory. Experiments illustrating and amplifying the lecture course are performed. These may be on adsorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is usually in the form of directed research.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conducttivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

Textile—Chemical Engineering—Preparation: B-11, B-12, B-13, B-23, C-20, C-24, C-42. A combination of lectures and laboratory work designed for the study of the thermal properties of fluids, laws of thermo-dynamics as applied to batch and flow processes, flow of heat, mechanical mixtures, and heat engines.

This course will include such practical applications to the dyeing, printing, and finishing branches of the textile industry as efficient use of steam in heating dye kettles—steam traps—measuring of steam used—calculating steam costs—study of best methods of piping steam for manufacturing purposes and economics of hot water storage.

Compression and fluid handling, testing of pumps, fans and similar chemical engineering equipment including some calibration of instruments will serve to give the student a general over-view of elementary chemical engineering.

Glass Blowing. A course in the elements of laboratory glass blowing, designed to give the man going into laboratory work a familiarity with the methods of handling both soda glass and Pyrex. All the ordinary seals and joints used in construction of apparatus are described and tried out in the laboratory.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D–10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–20. For Cotton Goods—Preparation: D–10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D–21. For Woolen and Worsted Goods—Preparation: D–10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the conside ation of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D–22. Preparation: D–10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D–23. Preparation: D–10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D–24. Preparation: D–10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power

looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, spooling and quilling, and the machinery for the same. A study is made of warpers and sizing machines for cotton, woolen, silk and rayon. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, cam looms, automatic shuttle changing looms, dobby looms, single and double acting dobbies, Knowles looms, leno weaving, center selvedge motion, automatic filling changing looms, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, the cutting and lacing of cards, and tying up Jacquard harness. The Baker automatic attachment for mixing the filling is also considered. [Courses I, II, III, VI.]

Power Weaving—D–24a. Preparation: D–10. This is a lecture course given during the first term and covers briefly the fundamentals of weaving, types of looms suitable for weaving different fabrics, warp preparation, especially slashing machinery and compounds for rayon, cotton, woolen and worsted yarns. [Course IV.]

Textile Design and Cloth Construction—D–30. Preparation: D–20 or D–21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

Power Weaving—D–32. Preparation: D–20, D–21, or D–23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen, worsted, cotton, silk and rayon; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. Automatic shuttle changing looms and automatic filling changing looms are taken up as well as the Baker attachment for mixing filling. [Courses I, II, III, VI.]

Color—D–33. A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question.

Dynamic Symmetry—D–34. A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. ([Courses III and VI, Options D, S.]

Jacquard Design and Weaving—D–40. Preparation: D–23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D–41. Preparation: D–10, D–20, D–21. The work in this course is the application of the instruction received during

the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art. This course is planned to give the fundamentals of design in its application to textiles. It includes such basic subjects as freehand drawing, perspective, historic ornament, and costume design. There naturally follows consideration of fashion trends, changes, and cycles. For those who desire and are qualified a limited course in pattern drafting with some sewing may be given as far as time permits.

LANGUAGE AND HISTORY DEPARTMENT—E

English—E-10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E-11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E-20. Preparation: E-10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E-21. Preparation: E-11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E-30. Preparation: E-10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production,

land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

Seminar in Business English—E–40. Preparation: E–10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON DEPARTMENT — F

Cotton Carding—F–20. Preparation: B–10, B–12, B–13. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin, Nasmith, and Saco-Lowell combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used

to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine, jack, and long draft roving are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F–20a. Preparation: B–10, B–12, B–13. This course is similar to Course F–20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–25. Preparation: B–12, D–10. This course covers the same lectures and laboratory work as F–31. [Course VI, Option D.]

Cotton Spinning—F–30. Preparation: F–20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of regular and long draft ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions. The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F–30a. Preparation: F–20a. This course is similar to Course F–30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F–31. Preparation: B–12, D–10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of

looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II, VI, Options C, W, S.]

Knitting—F-31a. Preparation: B-12, D-10. This course embraces the same lectures as Course F-31 but does not include any laboratory work. [Course VI, Option G.]

Cotton Organization—F-32. Preparation: F-20 or F-20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Knitting—F-35. Preparation: F-25. This course, given to students specializing in knitting, includes a more detailed study of hosiery and underwear manufacture with some time devoted to the manufacture of warp knit fabrics. [Course VI, Option G.]

Thesis—F-34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

Knitting—F-45. Preparation: F-35. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL DEPARTMENT—G

Fiber Preparation—G-20. Preparation: B-10, B-12, B-13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or which are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in scouring; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Carbonizing.—The various methods of stock carbonizing are explained in detail in the lecture course. Actual carbonizing of noil, burr waste, and defective wool is carried out by the sulphuric acid method on commercial size machines in the laboratory.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling

these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G-21. Preparation: B-10, B-12, B-13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.— Mixing and shading of colors and qualities of wool are studied and practiced. The details of Burr Pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W,D,S.]

Worsted Yarn Manufacture—G-30. Preparation: G-20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G-31. Preparation: B-23, F-30 or G-30, D-24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard

fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G-40. Preparation: C-21, C-32, D-10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H-30. Preparation: B-12, C-10, D-10, D-24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure. moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types

of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

CARBONIZING.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

GIGGING, NAPPING, STEAMING, SINGEING AND CRABBING.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

BRUSHING, SHEARING AND PRESSING.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H-31. Preparation: B-12, C-10, D-10, D-24. The outline of the course in the finishing of cotton fabrics is as follows:—

CLOTH ROOM.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

SHEARING.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

SINGEING.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

WASHING.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

NAPPING.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

WATER MANGLES.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

STARCH MANGLES.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds; pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

PHYSICAL EDUCATION

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

EQUIPMENT

The equipment of machinery, inventoried at $458,000.00, is most varied for textile educational purposes, and is being constantly augmented. The builders of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of a 40-inch Saco-Lowell three beater single process picker.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different

frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B–5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, two head Tompkins spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat-lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division. — The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company.

Installed by C. G. Sargent's Sons Corporation: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc.: One 120-spindle cam mule complete.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son: One card grinding stand with two traverse grinders complete.

Shoddy or Reworked Fiber Division. — Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division. — Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill

box, Taylor-Wordsworth & Co., equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops; two worsted combs with baller punch, one made by Crompton & Knowles, and the second made by James Smith & Sons; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works. In addition to this the Saco-Lowell Shops have installed the following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory as well as in the testing laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system of six humidifiers and four Comin's High Duty heads, under automatic control.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery was made by the Société Alsacienne de Constructions Mechaniques, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device, gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam -driven air compressor.

Textile Testing Division. — Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company; single yarn and fabric strength-testing machines made by G. R. Smith & Company; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company, a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, one General Electric mercury vapor lamp with stand for top inspection, one Edgerton stroboscope.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian

Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company. The Whitin Machine Company has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8 spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company.

The Weaving Department contains four looms supplied by the Draper Corporation, which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company has installed one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company. The Hopedale Manufacturing Company installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift, double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table. The Balance Room has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company.

The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé fractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with fifty-six steam heated dyeing baths and individual benches, reels and balances. There is also an ageing chamber and a Philadelphia Drying Machinery Company's Hurricane Dryer besides a large collection of dyestuffs.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, and a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine; a set of drying cans; a chain dyeing machine; a raw stock drying table; a padding mangle; a hydro-extractor; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company. The Franklin Process Company has furnished a 25-pound bronze dyeing machine.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company; a sample

fulling mill, a kicker mill, furnished by James Hunter & Company; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co.; a tentering and drying machine furnished by John Heathcote; a single crabbing machine, H. W. Butterworth & Son; a 72-inch woolen napper donated by Davis & Furber; a 32-inch basket hydro-extractor, W. H. Tolhurst; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company; a steam press for underwear, United States Hoffman Company; a sewing machine, Birch Brothers; a trimming and overseaming machine, The Merrow Machine Company.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine. Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber (the ball bearings were donated by the Fafnir Bearing Company); a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company; a trimming and overseaming machine, The Merrow Machine Company; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alden absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor

besides a General Electric 3-kilowatt rotary transformer and three Westinghouse stationary transformers. The other section is the instrument laboratory and is for the purpose of giving instruction in the measurement of current, voltage, resistance, and in the calibration of instruments. It is supplied with standard alternating and direct current measuring instruments of a wide range of sizes and capacities. A 160 ampere hour storage battery offers a source of constant voltage. A standard Leeds & Northrup photometer with Lummer-Brodhun screen and Macbeth illuminometer provide means of illumination measurements.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10 foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company; an engine lathe, 18-inch swing, 6 foot bed from Champion Tool Works; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son; one 14-inch single sensitive drill, from the Stanley Manufacturing Company; one No. 1 Universal grinder, from Landis Tool Company; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount; an American twist drill grinder, from the Heald Machine Company; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company; one 30-inch grindstone and frame, from the Athol Machine Company; a single spindle centering machine, from D. E. Whiton Machine Company; one 15-inch shaper, from Potter & Johnson; one power hacksaw, from the Fairbanks Company; one cold saw, from John T. Burr & Son; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

GRADUATES WITH TITLES OF THESES

June 6, 1939

Master of Science in Textile Engineering

Ion Maywood Bethel, Lowell, Mass. B.S., Texas Agricultural and Mechanical College, 1924. "A determination of correlation between certain physical characteristics of highly felted types of military woolen fabrics."

Walter Ferdinand Prien, Milwaukee, Wis. B.S., U. S. Naval Academy, 1930. "The construction and calibration of a trichromatic colorimeter."

Frank M. Steadman, Indianapolis, Ind. B.S., U. S. Military Academy, 1929. "A study of the relationship between the strength of certain worsted fabrics by the grab, tearing and bursting tests."

Bachelor of Textile Chemistry

As thesis for the degree of Bachelor of Textile Chemistry is now optional, no thesis subjects have been listed.

Herman Timothy Buckley	East Chelmsford, Mass.
Helen Jane Jarek	Lowell, Mass.
Samuel Levin	Lowell, Mass.
Sidney Robert Marsden	Lawrence, Mass.
Arnold Irving Miller	Lowell, Mass.
Harold Joseph Monahan	Dorchester, Mass.
Hubert James Murphy	North Chelmsford, Mass.
Herbert Charles Olsen	Reading, Mass.
James Peter Patsourakos	Lowell, Mass.
William Benjamin Prescott	Westford, Mass.
Warren Thomas Reddish, Jr.	Cincinnati, Ohio
Clyde Burton Rowntree	Lowell, Mass.
Edward Spevach	Carlstadt, N. J.
Burton Cole Winkler	Elizabeth, N. J.

Bachelor of Textile Engineering

Phyllis Jeanne Baker, Concord, Mass. "The relation of color and design in children's socks."

John Garrett Banta, Lowell, Mass. "Fashion trends in children's dresses from 1850 through 1938."

Albert Joseph Beauregard, Lowell, Mass. "A study of the trends of color and design in styles of women's outerwear from 1924 through 1939."

Arthur P. Stuart Bone, Lowell, Mass. "The merchandising of knitted sportswear."

Jackson Agmor Brantman, New York, N. Y. "Vertical integration in the knitted bathing suit industry."

Joseph Derzawetz, Boston, Mass. "The design, construction and calibration of an improved Walen evenness tester."

Henry Kendal Dick, Lowell, Mass. "The design and construction of apparatus to measure the luster of textile fabrics."

George Demetrios Gianaris, Lowell, Mass. "A study of the relation between the number of tests and the strength and variability of a two-ply worsted yarn."

John Lester Greene, Lowell, Mass. "The effect of various percentages of wool upon the breaking strength and the elongation of yarns made from rayon staple fiber and wool blends."

Estanislao Manaois Ocoma, B.S., Boston, Mass. "A study of the relationship between winding tension at the winder and the strength and elongation of single cotton yarns."

EILEEN MARGARET O'DONOGHUE, Lowell, Mass. "A survey of the methods used for testing the resilience and stiffness of fabrics."

EVERETT CARLTON REED, Chelmsford, Mass. "Construction of an apparatus for measuring the electrical resistance of textiles."

WILLIAM THORNCROFT REED, Lowell, Mass. "A study of the possibility of determining the weight per unit area of fabric from small circular ribbers when the cut of the machine is the only known factor."

SIDNEY STEINBERG, Brooklyn, N. Y. "A study of the merchandising of representative Raschel knitted novelties."

DIPLOMA IN COTTON MANUFACTURE

FRANK NORBERT BAUER, Waterloo, Ont. "The analysis of the manufacture of 5.75's yarn from different waste mixes and a comparison with a commercial sample."

VICTOR JOHN ESIELIONIS, Shirley, Mass. "The manufacture of cotton gabardine shirting."

ELDON STOWELL, A.B., Williamstown, Mass. "The relation of the strength of rayon staple fiber to spun rayon yarn."

DIPLOMA IN WOOL MANUFACTURE

LEONARD LEE COHEN, Rochester, N. Y. "Reproduction of a Harris tweed top-coating."

FREDERIC LAWRENCE EKSTRAND, Stafford Springs, Conn. "The manufacture of a Cheviot top-coating."

CLARENCE RUSSEL GAY, Lowell, Mass. "Reproduction of a Cheviot top-coating."

RALPH HARDING LITTLE, Rockville, Conn. "Reproduction of a fancy worsted suiting."

CHARLES ADELBERT MERRITT, Rockland, Me. Thesis with Leonard Lee Cohen.

SILAS MANDEVILLE WHEELOCK, JR., Putnam, Conn. "Reproduction of any authentic Campbell Scotch wool plaid."

ARTHUR CHARLES WIESNER, Lawrence, Mass. Thesis with Ralph Harding Little.

DIPLOMA IN TEXTILE DESIGN

RAYMOND SILBERSTEIN, Lowell, Mass.

Prizes awarded in June, 1939

The Medal of the National Association of Cotton Manufacturers awarded to the student who maintains the highest average in scholarship throughout the course. To *H. Kendall Dick.*

Louis A. Olney Prizes (in the form of books).

$10 to the student graduating from the Chemistry and Textile Coloring course, who, in the opinion of the instructing staff of the department, shall have maintained the highest scholarship through the course. To *Herbert C. Olsen.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *Irving P. Mintz.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *John A. Condon, Jr.* Honorable Mention: *Clarence B. Weil, William F. Ginivan, Sidney I. Saltsman.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Walter Lisien.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *Irving Paul Wolf.* Honorable Mention: *Stanley Szopa, Paul F. Noonan, Philip D. Caine.*

REGISTER OF DAY STUDENTS

Graduate Students

Home Address	*Lowell Address*
Buck, Roy Garvin, VI, Oakland, Calif. B.S., U. S. Naval Academy, 1933	———
Cooper, Harlan Cyril, VI, Indianapolis, Ind. B.S., U. S. Naval Academy, 1931	15 Garden Road
Jones, Charles Andrews, Jr., VI, Port Royal, Va. M.S., University of Wisconsin, 1927 B.S., Virginia Military Institute, 1919	———
Lizak, Boleck Louis, IV, Chicago, Ill. B.S., Lewis Institute, 1937	50 Standish Street
Smith, Lawrence, VI, Bloomfield, N. J. B.S., U. S. Naval Academy, 1932	28 Burtt Street
Swiatek, Bronislaw John, VI, Shirley, Mass. B.S., Tri-State College, 1938	———
Valvanis, Nicholas John, IV, Haverhill, Mass. B.S., Massachusetts State College, 1939	———

Undergraduate Students
Candidates for Degrees

Class of 1940

Aigen, Lawrence, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Balas, Fred Frank, VI, Lowell, Mass.	13 Third Street
Beltramini, Kenneth Charles, VI, Lowell, Mass.	Phi Psi House
Brooks, Raymond King, Jr., VI, Unionville, Conn.	Omicron Pi House
Bullock, Merlen Clarke, VI, Lowell, Mass.	38 Burtt Street
Campbell, Andrew Morris, IV, Lawrence, Mass.	———
Colby, Vernon Warren, IV, Haverhill, Mass.	———
Cunningham, Harold Russell, IV, Lowell, Mass.	7 Waite Street
Davis, Arthur Sabin, IV, Lowell, Mass.	105 Inland Street
Dori, Anita Marie, VI, Chester, Mass.	163 Sayles Street
Falk, Stanley, VI, Brooklyn, N. Y.	123 Riverside Street
Feuerstein, James Mayer, VI, Jamaica Plain, Mass.	Sigma Omega Psi House
Fox, Louise, VI, Dracut, Mass.	———
Fox, Theodore Webster, VI, Lowell, Mass.	359 Beacon Street
Fyfe, Robert Clark, VI, Lowell, Mass.	148 Riverside Street
Gill, John Schofield, IV, Andover, Mass.	———
Goodwin, John Alden, VI, Lowell, Mass.	111 Chestnut Street
Haas, Alexander Robert, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Hall, Richard Thomas, IV, Lowell, Mass.	54 Seventh Street
Hull, Robert Barney, VI, Lowell, Mass.	606 Stevens Street
Kahn, Seymour James, IV, Lowell, Mass.	116 Princeton Boulevard
Kiernan, James Vincent, VI, Dracut, Mass.	———
Lanner, Arthur William, IV, North Tewksbury, Mass.	———
Lynch, Edward Mark, IV, Lawrence, Mass.	———
McGilly, John Seede, VI, Lowell, Mass.	16 Talbot Street
Manning, Neil Joseph, IV, Lowell, Mass.	118 Mt. Washington Street
Maslanka, Edward John Felix, IV, Lowell, Mass.	5 Hampshire Street
Meuser, Rudolph Walter, VI, Pawtucket, R. I.	Omicron Pi House
Nelson, William Arthur, IV, Lowell, Mass.	896 Westford Street
Nuttall, Andrew Frederick, IV, North Billerica, Mass.	———
Pelt, Joseph Paul, Jr., VI, South Orange, N. J.	Phi Psi House
Ritchie, Newell Baird, IV, North Billerica, Mass.	———

Home Address	*Lowell Address*
Roth, Paul, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Rovner, Albert Hyman, VI, Chelsea, Mass.	———
Silverman, Joseph Melvin, VI, Winthrop, Mass.	———
Sweatt, Safford Pershing, IV, Lowell, Mass.	124 Stevens Street
Thayer, Walter Stephen, VI, Bennington, Vt.	337 Beacon Street
Thomas, Henry Edward, VI, Lowell, Mass.	41 Bellevue Street
Woodard, Malcolm Russell, IV, Chelmsford, Mass.	———

Class of 1941

Adie, Donald Miles, VI, Lowell, Mass.	26 Otis Street
Alexander, Gerard, VI, Kew Gardens, L. I., N. Y.	53 Mt. Hope Street
Bardzik, Thaddeus, IV, Dracut, Mass.	———
Batcheller, Ben Pitman, VI, Andover, Mass.	———
Biron, Joan Marguerite, VI, Lowell, Mass.	56 Fairlawn Street
Brown, Needham Ballou, Jr., VI, Andover, Mass.	———
Carmichael, Robert Dana, VI, Andover, Mass.	———
Condon, John Andrew, Jr., IV, North Billerica, Mass.	———
Cordeau, Georges Edward, IV, Lowell, Mass.	1014 Lakeview Avenue
Dubrule, Louis Joseph, IV, Lawrence, Mass.	———
Epstein, Edward Joseph, IV, Newark, N. J.	Sigma Omega Psi House
Factor, Sidney Wilfred, IV, Haverhill, Mass.	———
Finard, Saunder, IV, Revere, Mass.	———
Gari, Jose Via, VI, Mexico City, Mexico	11 White Street
Gass, Matthew, IV, Lowell, Mass.	201 Hildreth Street
Gatzimos, Aristophanes Demetrius, IV, Lowell, Mass.	172 Adams Street
Ginivan, William Francis, IV, Lowell, Mass.	50 Lamb Street
Greenbaum, Bernard Saul, IV, Haverhill, Mass.	———
Grondin, Abraham Hector, IV, Lowell, Mass.	111 Alma Street
Guilfoyle. Donald William, VI, Providence, R. I.	337 Beacon Street
Hamilton, Arthur Theodore, IV, Lowell, Mass.	337 Beacon Street
Higginbottom, George Stephen, IV, Lowell, Mass.	46 Otis Street
Hoffmann, Donald Augustus, IV, Montclair, N. J.	75 Pine Street
Inkpen, Norman Alfred, IV, Ward Hill, Mass.	———
James, Ernest Peter, IV, Haverhill, Mass.	———
Jay, Joshua Daniel, VI, Brooklyn, N. Y.	298 Riverside Street
Kaplan, Ralph Reuben, VI, Lowell, Mass.	43 Hawthorne Street
Koulas, Stanley Charles, IV, Chelmsford, Mass.	———
Landfield, Harold, IV, Dorchester, Mass.	445 High Street
Lane, Joseph James, 2nd, VI, Pittsfield, Me.	337 Beacon Street
Leary, Gordon Simpson, IV, Lowell, Mass.	834 Andover Street
Lewis, Dorothy Elaine, VI, Chelmsford, Mass.	———
Linden, Leo, VI, Chelsea, Mass.	———
McMahon, Joseph Justin, IV, Lowell, Mass.	7 Belmont Street
McTeague, George David, IV, Lowell, Mass.	298Riverside Street
Mahoney, Francis Vincent, Jr., IV, North Billerica, Mass.	———
Mason, Frederick Rufus, VI, Lowell, Mass.	12 White Street
Milberg, Maurice, VI, Brooklyn, N. Y.	75 Fourth Avenue
Mintz, Irving Paul, IV, Passaic, N. J.	148 Riverside Street
Murphy, Francis Arthur, IV, Brookline, Mass.	———
Okun, Seymour, VI, Brooklyn, N. Y.	337 Beacon Street
Patrick, Stephen Edmund, Jr., VI, Augusta, Me.	337 Beacon Street
Pernick, David, VI, Maspeth, L. I., N. Y.	298 Riverside Street
Phillips, Maurice Gordon, VI, Southbridge, Mass.	337 Beacon Street
Platt, Walter Wallace, IV, Lawrence, Mass.	———
Portilla, Jose Luis, VI, Mexico, D. F., Mexico	11 White Street

Home Address	*Lowell Address*
PULIAFICO, SALVATORE JOSEPH, IV, Barre Plains, Mass.	59 Crescent Street
RASHKIN, BERNARD, VI, Brooklyn, N. Y.	19 Mt. Hope Street
RICH, CHARLOTTE MERLINE, IV, Haverhill, Mass.	———
ROBERTS, ANGUS HENRY, IV, Lowell, Mass.	35 Wiggin Street
SALTSMAN, SIDNEY IRVING, IV, Lowell, Mass.	89 Washington Street
SCARMEAS, HARRY GEORGE, IV, Lowell, Mass.	21 Hancock Avenue
SCHIFFER, LATHROPE ADOLPH, VI, New York, N. Y.	Sigma Omega Psi House
SINSKI, HENRY ANTHONY, VI, Gardner, Mass.	123 Pleasant Street
SKALKEAS, BASIL GEORGE, IV, Lowell, Mass.	53 Avon Street
SULLIVAN, PAUL JOHN, IV, Lowell, Mass.	33 South Walker Street
SZYMOSEK, FRANK JOHN, IV, North Andover, Mass.	———
TARTIKOFF, JORDAN ALVIN, VI, Brooklyn, N. Y.	19 Mt. Hope Street
TURNER, GEORGE ROBERT, IV, Lowell, Mass.	Phi Psi House
UPTON, GEORGE JOSEPH, IV, Fitchburg, Mass.	———
URLAUB, GEORGE SAMUEL, IV, New York, N. Y.	298 Riverside Street
WEBB, RALPH PEABODY, VI, Dracut, Mass.	———
WEIL, CLARENCE BERNARD, IV, New York, N. Y.	148 Riverside Street
WOLF, IRVING JACOB, VI, Morristown, N. J.	Sigma Omega Psi House
WOODARD, ALICE MARJORIE. VI, Chelmsford, Mass.	———
ZARULES, GEORGE, IV, Peabody, Mass.	———
ZELLWEGER, RALPH JOHN, VI, Palisade, N. J.	Phi Psi House

Class of 1942

ALLARD, ERNEST HERBERT, IV, Lowell, Mass.	104 Eleventh Street
ANGELL, CHARLES FRANCIS, JR., IV, Chestnut Hill, Mass.	137 Riverside Street
ARMSTRONG, GEORGE GORDON, JR., VI, Littleton, Mass.	———
BAER, LEONARD HERMAN, VI, Brooklyn, N. Y.	Sigma Omega Psi House
BARNES, KENRICK, IV, Billerica, Mass.	———
BARRY, GERARD GEORGE, IV, Lowell, Mass.	539 Chelmsford Street
BLOCH, SEYMOUR SAMUEL, VI, Brookline, Mass.	43 Plymouth Street
BOULE, RAYMOND GEORGE, IV, Lowell, Mass.	66 Mt. Hope Street
BROOK, JOHN FREDERICK, VI, Simcoe, Ont.	125 Mt. Washington Street
BULSON, DOUGLAS WHITNEY, VI, Lowell, Mass.	43 Plymouth Street
CAINE, PHILIP DANIEL, IV, Lowell, Mass.	89 Puffer Street
CASAVANT, KENNETH ARTHUR, IV, Gardner, Mass.	63 Crawford Street
COFFIN, WILLIAM BURTON, IV, Melrose, Mass.	———
CORCORAN, LEONARD ROBERT, IV, Bradford, Mass.	———
COZAD, JUNE BERNICE, VI, Lowell, Mass.	136 Chestnut Street
CRYAN, THOMAS FRANCIS, VI, Lowell, Mass.	59 Temple Street
DEMITROPOULOS, ANDREW PETER, VI, Dracut, Mass.	———
DULLIGAN, WILLIAM CHARLES, VI, Lowell, Mass.	40 Saratoga Street
EICHNER, ALBERT DAVID, VI, New York, N. Y.	144 School Street
EVANS, PHILLIP CAMERON, IV, Lowell, Mass.	228 Wentworth Avenue
HAMER, DAVID ORVILLE, JR., IV, Dracut, Mass.	———
HARPER, CYRIL NEWCOMB, IV, Wakefield, Mass.	———
HORNUNG, SANFORD LEE, IV, Corning, N. Y.	137 Riverside Street
HUNTER, ROBERT ARNOLD, VI, Newbury, Mass.	Omicron Pi House
KENT, GEORGE, VI, Great Neck, L. I., N. Y.	50 Standish Street
LISIEN, WALTER, IV, Lowell, Mass.	85 Whipple Street
MCCARTNEY, ROBERT WALLACE, IV, Lowell, Mass.	16 Sidney Street
MCELHINNEY, DOUGLAS HAMILTON, IV, Passaic, N. J.	Omicron Pi House
MCMAHON, STILLMAN DILLON, IV, Lowell, Mass.	7 Belmont Street
MAHAN, FREDERICK JOSEPH, IV, Lowell, Mass.	825 Chelmsford Street
MANDIKOS, GEORGE JOHN, IV, Haverhill, Mass.	———
MOREAU, ARTHUR JOSEPH, IV, Lowell, Mass.	45 West Street
MURPHY, JOHN ANTHONY, IV, Lowell, Mass.	123 Andrews Street
NOONAN, PAUL FRANCIS, IV, Lowell, Mass.	45 By Street

Home Address	*Lowell Address*
Oppenheim, Morton Lewis, VI, Lawrence, Mass.	———
Pappas, Vasil James, IV, Dracut, Mass.	———
Peel, Robert Kenneth, VI, Worcester, Mass.	Omicron Pi House
Pettingill, Warren Martin, VI, Castle Point, N. Y.	148 Riverside Street
Pinatel, John Andre, VI, Paterson, N. J.	137 Riverside Street
Pratt, Caroline Elizabeth, IV, Lowell, Mass.	119 Fairmount Street
Rawlinson, Dustin, IV, Hampstead, N. H.	318 Pawtucket Street
Roberts, Russell Frederick, VI, Tyngsboro, Mass.	———
Rogoff, David, VI, Mattapan, Mass.	Sigma Omega Psi House
Roumas, Zenon Anthony, IV, Peabody, Mass.	———
Sandner, Charles Rodney, IV, Lawrence, Mass.	———
Sanford, George Morse, Jr., VI, Malden, Mass.	———
Schiffer, Clifford Elais, IV, New York, N. Y.	298 Riverside Street
Schiller, William, VI, Brookline, Mass.	268 Shaw Street
Schlesinger, Morton, IV, New York, N. Y.	Sigma Omega Psi House
Shafter, Stuart Frederic, IV, Lowell, Mass.	373 Beacon Street
Shapiro, Jeoffrey Joseph, VI, Brooklyn, N. Y.	148 Riverside Street
Smith, Francis Dunham, VI, Dover-Foxcroft, Me.	137 Riverside Street
Staklinski, Walter Albert, VI, Rockville, Conn.	37 Varney Street
Szopa, Stanley, IV, Lowell, Mass.	39 Beacon Street
Thomas, Donald Henry, IV, Medford, Mass.	———
Tomasuria, Joseph Charles, VI, Lawrence, Mass.	———
Wall, James Thomas, IV, Lowell, Mass.	157 Pleasant Street
Walwood, John Thomas, IV, Lowell, Mass.	144 A Street
Webster, Frederick Leonard, Jr., IV, Lowell, Mass.	167 D Street
Wolf, Irving Paul, IV, Brooklyn, N. Y.	Sigma Omega Psi House

Class of 1943

Allard, Claude Henry, IV, Lowell, Mass.	104 Eleventh Street
Allen, Craig, VI, Scarsdale, N. Y.	142 Riverside Street
Bailey, Hartley Allen, IV, Lowell, Mass.	15 Newbury Street
Beuter, Ralph Julius, VI, Richmond Hill, N. Y.	43 Plymouth Street
Bevington, Lawrence Elliott, IV, Lawrence, Mass.	———
Bisko, Stephen John, VI, Webster, Mass.	226 Riverside Street
Brown, Chandler Russell, IV, Marblehead, Mass.	Omicron Pi House
Bullock, Ralph Louis, IV, Lexington, Mass.	———
Cestari, Leo Fiormante, VI, Cedarhurst, N. Y.	43 Plymouth Street
Chevrette, Henry Anthony, VI, Watertown, Mass.	———
Colburn, John Allen, IV, Dracut, Mass.	———
Cotton, John Page, Jr., VI, Brookline, Mass.	63 Varnum Avenue
Coulman, Malcolm Prescott, IV, Saugus, Mass.	———
Davis, Esther Alice, IV, Lowell, Mass.	252 Middlesex Street
DeKalb, John Ernest, IV, Chelmsford, Mass.	———
DeMallie, Peter, IV, Lowell, Mass.	275 Gibson Street
Donnelly, Eliot Manning, VI, Amsterdam, N. Y.	43 Plymouth Street
Downey, George Pershing, IV, South Acton, Mass.	———
Drapeau, Raymond Herve, IV, Lowell, Mass.	6 Eighth Avenue
Dubisz, Stanley Joseph, VI, Manchester, N. H.	———
Foisy, Robert William, VI, Lowell, Mass.	55 Florence Road
Foster, Clarence Everett, VI, Dracut, Mass.	———
Fox, Barbara Elisabeth, IV, Dracut, Mass.	———
Freed, Herbert J., VI, Dorchester, Mass.	———
Garnett, Richard Herbert, VI, Edgewood, R. I.	53 Mt. Hope Street
Gillick, Thomas John, Jr., IV, Lowell, Mass.	47 South Walker Street
Glen, Cornelius Leonard, VI, North Tewksbury, Mass.	———
Goldberg, Herbert Arthur, VI, Dorchester, Mass.	Sigma Omega Psi House
Gray, Roland Hilton, VI, Tewksbury, Mass.	———

Home Address	*Lowell Address*
Hagerty, Francis William, VI, Lexington, Mass.	—
Haggerty, William Thomas, IV, Lowell, Mass.	28 Windsor Street
Harrison, Maurice William, VI, Lowell, Mass.	18 Bellevue Street
Haseltine, Robert Clifton, IV, Haverhill, Mass.	Omicron Pi House
Hicks, Stuart Grant, IV, Upper Montclair, N. J.	359 Beacon Street
Hochschild, Reine George, IV, Stepney, Conn.	123 Riverside Street
Hollingworth, Clifford Earl, IV, Dracut, Mass.	—
Howard, Philip John, IV, North Andover, Mass.	—
Johnson, John Thomas, IV, Lowell, Mass.	35 Barasford Avenue
Joslin, Stephen Perry, VI, Lowell, Mass.	577 School Street
Keirstead, Edith Louise, VI, Lowell, Mass.	34 Chauncey Avenue
Kelly, Allan William, VI, Lowell, Mass.	41 E Street
Kennedy, Matthew Anthony, VI, Lowell, Mass.	19 Dracut Street
Kittay, Morton Victor, VI, New York, N. Y.	Sigma Omega Psi House
Krintzman, Edward, VI, Worcester, Mass.	Sigma Omega Psi House
Lage, Mario Vieira, IV, Lowell, Mass.	163 Summer Street
LaRose, Ralph Bruce, IV, Winchester, Mass.	—
Leary, Eugene Whiteway, VI, Lowell, Mass.	834 Andover Street
Liang, Leland Sung, VI, Shanghai, China	53 Mt. Hope Street
Lombardi, Vincent Daniel, VI, Garden City, N. Y.	137 Riverside Street
Lygomenos, Peter Charles, IV, Peabody, Mass.	—
McLean, James Arthur, VI, Lowell, Mass.	30 Greenfield Street
McNellis, James Stanislaus, IV, Boston, Mass.	48 Prospect Street
Mallon, John Francis, IV, Lawrence, Mass.	—
Messer, Albert Sidney, IV, Ozone Park, N. Y.	63 Queen Street
Miller, Alex Michael, VI, Perth Amboy, N. J.	92 Gates Street
Morel, Gerard Charles, IV, Lawrence, Mass.	—
Morton, Jackson Wentworth, IV, Egypt, Mass.	—
Murray, Martin Patrick, IV, Lowell, Mass.	30 Cosgrove Street
O'Donnell, Thomas Francis, VI, Lowell, Mass.	398 Princeton Boulevard
O'Leary, Louise Margaret, IV, Dracut, Mass.	—
Osgood, Russell Lawrence, IV, Lawrence, Mass.	—
Panagiotakos, William Charles, IV, Lawrence, Mass.	—
Perez, Ulpiano Quinones, VI, Los Angeles, Calif.	43 Plymouth Street
Petersen, Richard Edward, IV, Concord, Mass.	—
Petricek, Bruno, VI, Clifton, N. J.	137 Riverside Street
Priestley, Joseph Amos, VI, Lowell, Mass.	78 Princeton Street
Queeney, John Hart, IV, Scituate, Mass.	75 Fourth Avenue
Quinn, Thomas Gregory, Jr., IV, Lowell, Mass.	58 Dover Street
Roberts, Donald Chester, VI, Tyngsboro, Mass.	—
Rowen, Edward Joseph, VI, West Roxbury, Mass.	65 Sterling Street
Rush, Richard Charles, IV, Shirley, Mass.	37 Orchard Street
Ryan, Joseph Michael, IV, Amesbury, Mass.	—
Sayers, John Timothy, Jr., IV, Lowell, Mass.	355 Princeton Street
Sidebottom, William James, IV, Milton, Mass.	272 Merrimack Street
Siegel, Harold, VI, Brooklyn, N. Y.	75 Fourth Avenue
Silberstein, Robert Herbert, VI, New York, N. Y.	43 Plymouth Street
Simon, Richard Bernard, IV, New York, N. Y.	Sigma Omega Psi House
Spanos, George Peter, IV, Lowell, Mass.	14 West Bowers Street
Strand, Richard Warren, IV, West Groton, Mass.	—
Sullivan, Paul Henry, IV, Haverhill, Mass.	—
Taylor, William Warren, VI, Chelmsford, Mass.	—
Teichner, Arthur Charles, IV, Chicago, Ill.	Sigma Omega Psi House
Towne, Allen Newman, IV, North Andover, Mass.	—
Tyrie, Wallace Rolley, IV, Bradford, Mass.	—
Valente, Louie Joseph, VI, South Barre, Mass.	280 Appleton Street
Webb, Jackson, VI, Lowell, Mass.	120 Warwick Street
White, Joseph Arthur, IV, Dracut, Mass.	—
Wielicka, Edward Dominic, IV, Lawrence, Mass.	—

Home Address	Lowell Address
Wilkinson, Vernon Lee, VI, Southbridge, Mass.	53 Mt. Hope Street
Winer, Allen, IV, Medford, Mass.	———
Zenorini, Henry John, VI, North Bergen, N. J.	32 Mt. Washington Street
Zenorini, Joseph Aedan, VI, Union City, N. J.	32 Mt. Washington Street

Diploma Students

Class of 1940

Hobson, Edward Shackford, III, Southbridge, Mass.	337 Beacon Street
Hockmeyer, Clive Edward, Jr., I, Lowell, Mass.	7 Whitman Street
Lannon, John Francis, Jr., II, Saylesville, R. I.	337 Beacon Street
Mackle, Chauncey Jacob, II, Lowell, Mass.	53 Mt. Hope Street
Mejia, Eduardo, B.S., I, Medellin, Colombia, S. A.	247 Appleton Street
Proulx, Arthur Anthony, II, Lowell, Mass.	65 Sterling Street
Rees, Richard Holmes, I, Townsend Harbor, Mass.	———
Yacubian, Gamaliel Mardiros, II, Somerville, Mass.	———

Class of 1941

Blanchard, Armand Eugene, III, Southbridge, Mass.	173 A Street
Callahan, George Paul, II, Medford, Mass.	———
Campbell, John Duncan, II, South Boston, Mass.	37 Varney Street
Dick, Rudolph Carl, Jr., I, Swampscott, Mass.	Phi Psi House
Fead, Robert William, II, Port Huron, Mich.	Phi Psi House
Garnett, Stanley Arthur, II, Edgewood, R. I.	53 Mt. Hope Street
Johnson, Roy Theodore, III, Chelmsford, Mass.	———
Koroskys, Michael Joseph, II, North Andover, Mass.	———
Macktez, Lester Allen, II, Woonsocket, R. I.	Sigma Omega Psi House
Pearsall, Samuel, II, Hamilton, N. Y.	337 Beacon Street

Class of 1942

Brook, George Henry, II, Simcoe, Ont.	14 Mt. Washington Street
Clark, George Carlyle, II, Methuen, Mass.	———
Dolge, David Bigelow, II, Hazardville, Conn.	Omicron Pi House
Frank, Arthur Joseph, II, Lowell, Mass.	72 Montview Avenue
Harris, Carl Webster, II, Penacook, N. H.	37 Varney Street
Hayward, William Edwin, II, Franklin, Mass.	Phi Psi House
Lodge, John, 2nd, II, Chestnut Hill, Mass.	Omicron Pi House
Meany, John Lawless, II, Leominster, Mass.	142 Riverside Street
Pesetzky, Herbert, III, New York, N. Y.	24 Holden Street
Rand, Woodbury Holmes, II, Brookline, Mass.	———
Robinson, John Bailey, II, Oxford, Me.	50 Standish Street
Sandman, Milton Eugene, III, Brookline, Mass.	Sigma Omega Psi
Whiting, Frank Edward, II, Andover, Mass.	———

Specials

Agey, Peter Stephen, VI, North Andover, Mass.	———
Barker, John Chester, III, Lowell, Mass.	98 Perry Street
Baxter, Jessie, III, Boston, Mass.	———
Day, Dorothea Elizabeth, III, West Roxbury, Mass.	———
Finn, Joseph Francis, IV, Milton, Mass.	Phi Psi House
Kostrewa, Stanley Michael, III, Methuen, Mass.	———
MacAusland, Douglas Ray, III, Lowell, Mass.	280 Gibson Street
Mooar, Clarence Warren, III, Andover, Mass.	———
Norton, William Francis, II, East Boston, Mass.	476 Merrimack Street
Richardson, June Beatrice, III, Lowell, Mass.	26 Wood Street
Sousa, Albert Joseph, II, East Chelmsford, Mass.	———
Varoski, Alphonse John, II, Lowell, Mass.	37 Chapel Street
Wlodyka, Raymond, III, Methuen, Mass.	———
Woodward, John, III, Andover, Mass.	———

ALPHABETICAL LIST OF GRADUATES

Master of Science degree was first given in 1936. Other degrees were issued beginning with the year 1913 as follows: B.T.C.—Bachelor of Textile Chemistry; B.T.D.—Bachelor of Textile Dyeing; B.T.E.—Bachelor of Textile Engineering. A diploma is indicated by D and a certificate (covering a partial course only) by C.

The following list has been corrected in accordance with information received previous to February 1, 1940. Any information regarding incorrect or missing addresses is earnestly solicited.

Abbot, Edward Moseley, II, '04 (D). President and General Manager, Abbot Worsted Company, Graniteville, Mass.
Abbott, George Richard, II, '08 (D). Tree Warden, Andover, Mass.
Acar, Ibrahim Zeki, VI, '38 (M.S.). Istanbul, Turkey, Hale Apt. No. 3, 'Sair Nigâr Sok Pangalti.
Adams, Floyd Willington, VI, '16 (B.T.E.).
Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.
Adams, Tracy Addison, IV, '11 (D). Vice-President and General Manager, Arnold Print Works, North Adams, Mass.
Albrecht, Charles Henry, IV, '17 (B.T.C.). Chief Chemist, Atlantic Mills, Providence, R. I.
Alcott, Albert Stephen, Jr., IV, '35 (B.T.C.), '36 (M.S.). With New England Telephone & Telegraph Co., Framingham, Mass.
Allard, Edward Joseph, IV, '31 (B.T.C.). Salesman and Demonstrator, National Aniline & Chemical Company, Providence, R. I.
Allen, Grover Stanley, IV, '34 (B.T.C.). With M. T. Stevens & Sons Co., Haverhill, Mass.
Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.
Anderson, Arthur Illman, IV, '24 (B.T.C.). Textile Chemist, Superintendent of Research, American Institute of Laundering, Joliet, Ill.
Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City.
Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Hathaway Manufacturing Company, New Bedford, Mass.
Anderson, Harold Robert, II, '26 (D). With Abbot Worsted Company, Forge Village, Mass.
Annan, David, II, '23 (D). 105 Almont Street, Winthrop, Mass.
Anthony, Henry Steere, Jr., IV, '36 (B.T.C.). Assistant Chemist, Tyer Rubber Company, Andover, Mass.
Appel, Mrs. Bessie L. (Lifland, Bessie), IV, '32 (B.T.C.). Assistant Chemist, Massachusetts Knitting Mill, Jamaica Plain, Mass.
Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Superintendent of Dyeing, Sayles Finishing Plants, Inc., Saylesville, R. I.
Arundale, Henry Barnes, II, '07 (D). Development and Research Engineer, Atwood Machine Company, Stonington, Conn.
Atwood, Henry Jones, II, '23 (D). Agent, Amos Abbott Company, Dexter, Me.

Babb, Charles Wilkes, Jr., II '31 (D). With Knox Woolen Company, Camden, Maine.
Babigan, Edward IV, '33 (B.T.C.). With Outlet Fruit Company, Lowell, Mass.
Babigan, Raymond, IV, '24 (B.T.C.). Examiner, United States Patent Office, Washington, D. C.
Bachelder, Charles Edward, IV, '24 (B.T.C.). Superintendent of Acetate Yarn Division, Tennessee Eastman Corporation, Kingsport, Tenn.
Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). Time Study Department, Worsted Division, Pacific Mills, Lawrence, Mass.
Bailey, Lester Harold, IV, '24 (B.T.C.). 32 Lincoln Avenue, Norwich, Conn.
Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.
Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.
Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.
Baker, Phyllis Jeanne, VI, '39 (B.T.E.). Concord Turnpike, Oriole Gardens, Concord, Mass.

Baker, William John, IV, '16 (D). Manufacturing Superintendent, E. I. du Pont de Nemours & Co., Buffalo, N. Y.
Baker, William Samuel, I, '26 (D). Assistant Systemizer, Nashua Manufacturing Company, Nashua, N. H.
Balch, Ralph Herman, VI, '29 (B.T.E.). Development Engineer, Celanese Corporation of America, Amcelle, Md.
Baldwin, Frederick Albert, II, '04 (D). President, Federal Clothing Manufacturing Company, Ltd., Sherbrooke, Que.
Banta, John Garrett, VI, '39 (B.T.E.). Assistant Sales Manager, Curvon Corporation, 419 Fourth Avenue, New York City.
Bard, Morry Arnold, IV, '30 (B.T.C.). President, Silver Line Dye Works, Inc., New York City.
Barlofsky, Archie, VI, '17 (B.T.E.). Attorney at law, Barlofsky & Barlofsky, Lowell, Mass.
Barr, I. Walwin, I, '00 (D). 1st Vice-President, Buckley Brothers Company, 881 Broadway, New York City.
Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co., North Bergen, N. J.
Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.
Barry, Marie Gertrude, IV, '32 (B.T.C.). In Charge of Fastness Tests, National Aniline & Chemical Co., Buffalo, N. Y.
Basdikis, Charles Apostolos, IV, '36 (B.T.C.). 8 Lagrange Street, Lowell, Mass.
Bassett, Louis Loss, VI, '37 (B.T.E.). Manufacturer, Glenbar Fabrics, Lowell, Mass.
Bates, Wesley Elliot, VI, '36 (B.T.E.). Second Hand, Carding & Spinning, Chicopee Manufacturing Corporation, Chicopee Falls, Mass.
Bauer, Frank Norbert, I, '39 (D). 186 King Street, South, Waterloo, Ont.
Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.
Beauregard, Albert Joseph, VI, '39 (B.T.E.). Designer and Stylist, Worumbo Manufacturing Company, 51 Madison Avenue, New York City.
Beattie, John Silas, IV, '35 (B.T.C.). Technician, American Viscose Corporation, Marcus Hook, Pa.
Beck, Frederic Christian, II, '24 (D). In business. Weld & Beck, Southbridge, Mass.
Beeman, Earl Royal, VI, '30 (B.T.E.). Superintendent, No. 1 Mill, Pacific Mills, Dover, N. H.
Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline & Chemical Company, Buffalo, N. Y.
Bell, Edward Benjamin, IV, '24 (B.T.C.). Chemical Sales, Calgon, Inc., Lowell, Mass.
Bennett, E. Howard, II, '03 (C). Publisher, American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass.
Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.
Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.
Berry, Wilbur French, II, '17 (D). Superintendent, Thomas Kay Woolen Mill Company, Salem, Oreg.
Bertrand, Arthur Leon, IV, '32 (B.T.C.).
Bethel, Ion Maywood, VI, '39 (M.S.) (B.S., Texas Agricultural and Mechanical College, 1925). Captain, U. S. Marine Corps, Depot of Supplies, Philadelphia, Pa.
Bienstock, George Jerrard, III, '24 (D). Designer and Stylist, Yorkshire Worsted Mills, New York, N. Y.
Billings, Borden Dickinson, I, '29 (D).
Bird, Clarence Henry, II, '22 (D). Superintendent, George E. Duffy Manufacturing Co., Worcester, Mass.
Bird, Francis John, VI, '22 (B.T.E.). Attorney-at-Law, 227 Bronson Building, Attleboro, Mass.
Birtwell, John Lincoln, IV, '34 (B.T.C.). 1641 Gorham Street, East Chelmsford, Mass.
Blaikie, Howard Mills, II, '11 (D). Salesman, Kitchen Kraft Food Corporation, Brooklyn, N. Y.
Blake, Parker Gould, VI, '14 (D). Partner, Parker Blake & Clinton Long, Ltd., 94 Wellington Street, West, Toronto, Ont.
Blanchard, John Lawrence, II, '23 (D). Superintendent, Faith Mills, Inc., Averill Park, N. Y.
Bodwell, Henry Albert, II, '00 (D). Ludlow Manufacturing & Sales Company, 211 Congress Street, Boston, Mass.
Bogdan, John Francis, VI, '35 (B.T.E.). With Manville Jenckes Corporation, Manville, R. I.

Bone, Arthur Peter Stuart, VI, '39 (B.T.E.) With Arthur Bone, Inc., Los Angeles, Calif.

Boordetsky, Sidney Morris, VI, '37 (B.T.E.). 5 Jones Street, Dorchester, Mass.

Booth, James Mooney, IV, '24 (B.T.C.). Technical Sales, The Huron Milling Company, 9 Park Place, New York City.

Bottomley, John, III, '28 (D). Assistant Styler, Joshua L. Bailey & Co., 40 Worth Street, New York City.

Boynton, Bradford Lewis, II, '35 (D). With Munro, Kincaid, Edgehill, Inc., Boston, Mass.

Bradford, Edward Hosmer, VI, '35 (B.T.E.). Assistant to Overseer of Carding, Manville-Jenckes Corporation, Manville, R. I.

Bradford, Harold Palmer, II, '25 (D).

Bradford, Roy Hosmer, II, '06 (D). Textile Machinery Agent and Appraiser, 161 Devonshire Street, Boston, Mass.

Bradford, William Swanton, VI, '31 (B.T.E.). Tarratine, Somerset Junction, Me.

Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.

Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.

Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, Inc., 325 West Huron Street, Chicago, Ill.

Brainerd, Carl Emil, IV, '20 (B.T.C.). Dyer, F. C. Huyck & Sons, Albany, N. Y.

Brandt, Carl Dewey, VI, '20 (B.T.E.). Research Engineer, Whitin Machine Works, Whitinsville, Mass.

Brannen, Leon Vincent, III, '07 (C).

Brantman, Jackson Agmor, VI, '39 (B.T.E.). Textile Technician, Golding Brothers Company, Inc., New York City.

Brickett, Chauncy Jackson, II, '00 (D). Director, Schools of Textile Manufacturing and Designing, International Correspondence School, Scranton, Pa.

Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.

Bridges, Herbert Gardner, II, '34 (D). Office Manager and Representative, The New Hampshire Company, Portsmouth, N. H.

Brigham, Howard Mason, VI, '24 (B.T.E.). Sales Executor, Wellington, Sears Co., 65 Worth Street, New York City.

Broadhurst, Russell Denton, IV, '38 (B.T.C.). 2 Laurel Street, Middletown, Conn.

Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.

Brosnan, William Francis, IV, '27 (B.T.C.). Superintendent of Dyeing & Finishing, Farr Alpaca Company, Holyoke, Mass.

Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.

Brown, Philip Franklin, II, '23 (D). Assistant Sales Director, E. I. DuPont de Nemours, Rayon Division, Wilmington, Del.

Brown, Rollins Goldthwaite, IV, '12 (D).

Brown, Russell Lee, VI, '21 (B.T.E.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.

Brown, Will George, Jr., IV, '22 (B.T.C.). Salesman, Wallerstein Company, 180 Madison Avenue, New York City.

Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.

Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.

Buckley, Herman Timothy, IV, '39 (B.T.C.). Assistant Chemist, J. L. Stifel & Sons, Wheeling, W. Va.

Bukala, Mitchell John, IV, '34 (B.T.C.). Chemist, Massachusetts Mohair Plush Company, Lowell, Mass.

Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.

Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.

Burke, James Edward, Jr., IV, '34 (B.T.C.). With Newmarket Manufacturing Company, Lowell, Mass.

Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous, Inc., Lawrence, Mass.

Burns, Robert, IV, '28 (B.T.C.). With Celanese Corporation of America, 180 Madison Avenue, New York, N. Y.

Burtt, Joseph Frederic, VI, '31 (B.T.E.). Assistant Superintendent, Abbott Worsted Company, Forge Village, Mass.

Buzzell, Harry Saville, VI, '29 (B.T.E.). Supervisor of Sample Department, Oxford Paper Company, Rumford, Maine.

Calder, Marian Brownson, VI, '37 (M.S.). (B.S. 1930, College of Industrial Arts, Texas State College for Women.) With Good Housekeeping Institute, New York City.

Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.

Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.

Campbell, Alexander, VI, '23 (B.T.E.). Assistant Engineer, Arlington Mills, Lawrence, Mass.

Campbell, Allan, Jr., VI, '32 (B.T.E.). With A. & A. Campbell Co., South Boston, Mass.

Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place, Boston, Mass.

Campbell, Orison Sargent, II, '03 (D). President and Manager, Industrial Felts, Ltd., New Hamburg, Ont.

Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Manager, Carlton Hotel, Malden, Mass.

Carbone, Alfred John, IV, '31 (B.T.C.). Chemist and Colorist, Sandoz Chemical Works, Philadelphia, Pa.

Carleton, Joseph Raddin, III, '30 (D). Designer, Bridgeport Fabrics, Inc., Bridgeport, Conn.

Carr, George Everett, I, '05 (D). 343 5th Street, Ridgefield Park, N. J.

Carr, Paul Edward, II, '24 (D). Styler, Assabet Mills, Dept. 11, American Woolen Company, 225 Fourth Avenue, New York City.

Carroll, Hugh Francis, IV, '38 (B.T.C.). Research Chemist, American Institute of Laundering, Joliet, Ill.

Carter, Robert Albion, IV, '02 (D). Dyestuff Salesman, E. I. du Pont de Nemours & Co., Greenfield, Reading, Pa.

Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.

Cary, Julian Clinton, VI, '10 (D). Branch Manager, The American Mutual Liability Insurance Company, 12 Haynes Street, Hartford, Conn.

Casey, Francis Harold, IV, '31 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., Boston, Mass.

Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton, N. J.

Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.

Chandler, Proctor, IV, '11 (D). With Packard Mills, Webster, Mass.

Chang, Chi, VI, '23 (B.T.E.).

Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Spinning & Weaving Co., 392 Nanking Road, Shanghai, China.

Chapman, Leland Hildreth, VI, '24 (B.T.E.). Pepperell, Mass.

Chen, Shih Ching, IV, '22 (B.T.C.).

Chen, Wen-Pei, IV, '24 (B.T.C.). Shanghai Bureau of Inspection, Shanghai, China.

Church, Charles Royal, II, '06 (C). Physical Education Instructor, San Diego High School, San Diego, Calif.

Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.

Clark, Earl William, IV, '18 (B.T.C.). Chemist, National Aniline & Chemical Co., Inc., Buffalo, N. Y.

Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.

Clarke, George Dean, II, '21 (C). 338 East Main Street, Avon, Mass.

Clayton, Harold Edmund, VI, '21 (B.T.E.). Manager, Clayton Hosiery Mills, Inc., Lowell, Mass.

Cleary, Charles Joseph, II, '13 (D). Senior Materials Test Engineer, United States Army Air Corps, Dayton, Ohio.

Clement, David Scott, IV, '24 (B.T.C.). Overseer of Dyeing, Nashua Manufacturing Company, Nashua, N. H.

Cleveland, Richard Sumner, VI, '30 (B.T.E.). Associate Materials Engineer, U. S. Maritime Commission, Washington, D. C.

Clifford, Albert Chester, VI, '22 (B.T.E.). Textile Engineer, Western Electric Company, Inc., Kearny, N. J.

Clogston, Raymond B., IV, '04 (D). Divisional Superintendent of Dyeing, Merrimack Manufacturing Company, Lowell, Mass.

Cluett, John Girvin, I, '29 (D). Sanforizing Engineer, Cluett, Peabody & Co., Inc., Troy, N. Y.

Coan, Charles Bisbee, IV, '12 (D). Salesman and Demonstrator, American Aniline Products Company, Boston, Mass.
Cobb, Joseph Calvin, VI, '36 (B.T.E.). Office Manager and Representative, Middlesex Paper Tube Company of New Jersey, Trenton, N. J.
Coffey, Daniel Joseph, III, '28 (D). Blanket Inspector, F. C. Huyck & Sons, Rensselaer, N. Y.
Cohen, Arthur Edward, IV, '23 (B.T.C.). With National Hosiery Dyeing and Finishing Works, Boston, Mass.
Cohen, Leonard Lee, II, '39 (D). 237 Berkeley Street, Rochester, N. Y.
Cohen, Raphael Edvab, IV, '25 (B.T.C.). Sales Manager, Merrimack Paper Tube Company, Inc., Lowell, Mass.
Colby, J. Tracy, VI, '16 (D). Sales Manager, F. C. Huyck & Sons, Empire State Building, Room 3318, New York City.
Colby, Willard Alvah, Jr., IV, '30 (B.T.C.). Boss Dyer, Danvers Bleachery, Peabody, Mass.
Cole, Edward Earle, IV, '06 (D). 191 Merrimack Street, Haverhill, Mass.
Collonan, Herbert Joseph, II, '22 (D). With Potter & Collonan, Moosup, Conn.
Coman, James Groesbeck, I, '07 (D). Manager, Mexia Textile Mills, Mexia, Texas.
Conant, Harold Wright, I, '09 (D). Assistant Treasurer, United Elastic Corporation, Easthampton, Mass.
Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears Company, 65 Worth Street, New York City.
Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.
Connolly, Daniel Francis, Jr., VI, '35 (B.T.E.). With Naumkeag Steam Cotton Company, Salem, Mass.
Connor, Thomas Francis, II, '28 (D). North Cohasset, Mass.
Connorton, John Joseph, Jr., III, '27 (D). Assistant Agent, Amoskeag Fabrics, Inc., Manchester, N. H.
Cook, Kenneth Bartlett, I, '13 (D). Vice-President in Charge of Manufacturing, Manville-Jenckes Company, Manville, R. I.
Corbett, James Francis, IV, '28 (B.T.C.). Chemist, Pacific Mills, Lawrence, Mass.
Cote, Theodore Charles, IV, '26 (B.T.C.). Chemist, Merrimack Manufacturing Company, Lowell, Mass.
Cowan, Raymond Bernard, IV, '35 (B.T.C.). Of Cowan & Shain, Ballardvale, Mass.
Craig, Albert Wood, IV, '07 (D). Superintendent, Windsor Print Works, North Adams, Mass.
Craig, Clarence Eugene, III, '02 (D). 1730 Centre Street, West Roxbury, Mass.
Crane, Eugene Francis, II, '33 (D). With East Weymouth Wool Scouring Company East Weymouth, Mass.
Crawford, Robert Thomas, VI, '36 (B.T.E.). Development Engineer, Tennessee Eastman Corporation, Kingsport, Tenn.
Creese, Guy Talbot, IV, '14 (D). General Manager, Creese & Cook Company, Danversport, Mass.
Crowe, Joseph Bailey, IV, '25 (B.T.C.). Director of Laundry and Textile Research, Procter & Gamble Co., Ivorydale, Ohio.
Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.
Cummings, Edward Stanton, VI, '16 (D). Industrial Engineer, R. E. Loper Company, Greenville, S. C.
Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.
Currier, Herbert Augustus, I, '06 (D). Vice-President, Waterman, Currier & Co., Inc., 40 Worth Street, New York City.
Currier, John Alva, II, '01 (D). Superintendent, Fabrics Department, M. T. Stevens & Sons Co., North Andover, Mass.
Curtin, William John, IV, '35 (B.T.C.). District Manager, Lowell Sun, Lowell, Mass.
Curtis, Frank Mitchell, I, '06 (D). Salesman, Barney Carey Company, Milton, Mass.
Curtis, William Leavitt, II, '05 (C).
Cutler, Benjamin Winthrop, Jr., III, '04 (D). Department Manager, Worth Textile Company, 40 Worth Street, New York City.

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Joslin, Harold Wheeler, II, '28 (D). Second Hand, Finishing, Lebanon Woolen Mills, Inc., Lebanon, N. H.
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Laughlin, James Knowlton, III, '09 (D).
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Lifland, Abraham, IV, '31 (B.T.C.). Assistant Dyer, Artistic Dyeing Company, Brooklyn, N. Y.
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MacPherson, Wallace Angus, III, '04 (D). Designer, Wuskanut Mills, Inc., Farnumsville, Mass.

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Manning, Frederick David, IV, '10 (D). Budget Director, American Type Founders Company, Elizabeth, N. J.

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Marshall, Chester Stanley, II, '22 (D). Superintendent, Peerless Weaving Company, Pawtucket, R. I.

Martin, Harry Warren, IV, '11 (D). Manager of Footwear, Hood Rubber Company, Inc., Watertown, Mass.

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Mathieu, Alfred Jules, II, '20 (D). Salesman, Dyeing and Combing, French Worsted Company, Woonsocket, R. I.

Matthews, Elmer Clark, II, '17 (D). Treasurer and General Manager, Thermo Mills, Inc., Hudson, N. Y.

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Mauersberger, Herbert Richard Carl, III, '18 (D). Technical Editor, Rayon Publishing Corporation, 303 Fifth Avenue, New York City.

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Meadows, William Ransom, I, '04 (D). Cotton Registrar, Chicago Board of Trade, Chicago, Ill.

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Meek, Lotta, IIIb, '07 (C). See Parker, Mrs. Herbert L.

Meeker, Samuel, IV, '27 (B.T.C.). Chemist, Aridye Corporation, Fairlawn, N. J.

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Meinelt, Herbert Eugene, IV, '32 (B.T.C.). With Lorraine Manufacturing Company, Pawtucket, R. I.
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Merritt, Charles Adelbert, II, '39 (D). Designer, Knox Woolen Company, Camden Me.
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Mitchell, Charles Alvah, II, '24 (D).
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O'Donnell, John Delaney, I, '04 (C).
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Olsen, Herbert Charles, IV, '39 (B.T.C.). Textile Chemist, National Starch Products, Inc., 820 Greenwich Street, New York City.
Olson, Carl Oscar, II, '24 (D). Proprietor, Budget Beauty Salon, Hartford, Conn.
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Parechanian, James Humphrey, IV, '35 (B.T.C.), '38 (M.S.). Assistant Chemist, U. S. Rubber Company, Naugatuck Chemical Division, Naugatuck, Conn.
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Parker, John George, Jr., IV, '31 (B.T.C.).
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Pease, Chester Chapin, I, '09 (D). With Jackson Mills, Nashua, N. H.
Pease, Kilburn Gray, I, '38 (D). With Jackson Mills, Nashua, N. H.
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Pottinger, James Gilbert, II, '12 (D). President and Treasurer, Everlastik, Inc., 181 Spencer Avenue, Chelsea, Mass.
Powers, Walter Wellington, IV, '20 (B.T.C.). Sales Department, Monsanto Chemical Company, Springfield, Mass.
Pradel, Alois Joseph, III, '00 (D). Designer, Killingly Worsted Company, Danielson, Conn.
Pradel, Mrs. Alois J. (Walker, Anna G.), IIIb, '03 (C). 78 Broad Street, Danielson, Conn.
Precourt, Joseph Octave, VI, '21 (B.T.E.). Cotton Yarn Salesman, January & Wood Co., 222 West Adams Street, Chicago, Ill.
Prescott, Walker Flanders, IV, '09 (D). Manager, Prescott & Co., Reg'd, 774 Saint Paul Street, West, Montreal, Can.
Prescott, William Benjamin, IV, '39 (B.T.C.). Colorist, Calco Chemical Division, American Cyanamid and Chemical Company, 35 Hartford Street, Boston, Mass.
Preston, Harold Lawrence, VI, '30 (B.T.E.). Sales Engineer, Chester C. Stewart Company, 8 Beacon St., Boston, Mass.
Prien, Walter Ferdinand, Lt. (SC) U.S.N., VI, '39 (M.S.). (**B.S., U. S. Naval Academy, 1930.**) Textile Inspection Officer, Naval Clothing Depot, Brooklyn, N. Y.

Putnam, George Ives, IV, '16 (B.T.D.).
Putnam, Leverett Nelson, IV, '10 (D). Overseer of Dyeing, Pacific Mills (Worsted Division), Lawrence, Mass.
Putnam, Philip Clayton, IV, '13 (D). Overseer of Dyeing, Apponaug Company, Apponaug, R. I.

Qualey, Francis Joseph, IV, '38 (B.T.C.). 126 London Street, Lowell, Mass.
Quigley, Gerald Francis, IV, '31 (B.T.C.). With Franklin Rayon Corporation, Providence, R. I.
Quinlan, William Harold, VI, '20 (B.T.E.). 171 Highland Street, Worcester, Mass.

Radford, Garland, II, '20 (D). Vice-President, Oriental Textile Mills, Houston, Texas.
Ramsdell, Theodore Ellis, I, '02 (D). President, Monument Mills, Housatonic, Mass.
Rawlinson, Richard William, VI, '31 (B.T.E.). Designer, Nashua Manufacturing Company, Nashua, N. H.
Ray, Lloyd Sanford, IV, '30 (B.T.C.). Chemist and Electro Plater, Excelsior Hardware Company, Stamford, Conn.
Raymond, Charles Abel, IV, '07 (D). Silviculturist, Essex, Mass.
Recher, Theodore, VI, '33 (B.T.E.). President and Treasurer, The Recher Corporation, Providence, R. I.
Redding, Leslie Capron, II, '26 (D). Designer, Wm. H. Prendergast Mills, Inc., Bridgeton, R. I.
Reddish, Charles Warren, IV, '38 (B.T.C.). Vice-President, W. C. Hardesty Company, Inc., Dover, Ohio.
Reddish, Warren Thomas, Jr., IV, '39 (B.T.C.). Proprietor, City Dye Works, Inc., 1159 State Street, Springfield, Mass.
Redmond, James Reynolds, IV, '36 (B.T.C.). Assistant Technologist, U. S. Quartermaster Corps, Jeffersonville, Ind.
Reed, Everett Carlton, VI, '39 (B.T.E.). With Albany Felt Company, Albany, N. Y.
Reed, Harold Ernest, VI, '37 (B.T.E.). Principal, Schools of Textile Manufacturing and Designing, International Correspondence Schools, Scranton, Pa.
Reed, Norman Bagnell, I, '10 (D). Manager, Lowell Hosiery Mills, Inc., Lowell, Mass.
Reed, William Thorncroft, VI, '39 (B.T.E.). Warp Knitting Machine Fitter, Whitin Machine Works, Whitinsville, Mass.
Regan, Paul William, IV, '37 (B.T.C.). Assistant Dyer, Crompton-Shenandoah Company, Waynesboro, Pa.
Reinhold, Kurt Herman, VI, '28 (B.T.E.). 354 East Broadway, Fulton, N. Y.
Reynolds, Fred Bartlett, II, '08 (D). Purchasing Agent, M. T. Stevens & Sons Company, North Andover, Mass.
Reynolds, Isabel Halliday, III, '03 (C). Clerk, Pacific Mills Print Works, Lawrence, Mass.
Reynolds, Raymond, II, '24 (D). Supervisor, DuPont Rayon Company, Buffalo, N. Y.
Rice, Josiah Alfred, Jr., III, '20 (D). Merchandise Manager, Marshall Field & Co., 200 Madison Avenue, New York City.
Rice, Kenneth Earl, VI, '29 (B.T.E.). With Sidney Blumenthal & Co., Shelton, Conn.
Rich, Edward, IV, '15 (B.T.D.). Manager, Jackson Caldwell Company, East Boston, Mass.
Rich, Everett Blaine, III, '11 (D). "Onacove," Sewall Road, Wolfeboro, N. H.
Rich, Milton Scott, II, '22 (D). Assistant Purchasing Agent, Harvard University, Cambridge, Mass.
Richardson, George Oliver, IV, '16 (B.T.D.). Manager, Special Products Division, National Aniline and Chemical Company, Inc., 40 Rector Street, New York City.
Richardson, Richardson Perry, I, '13 (D). Salesman, H. F. Livermore Company, Boston, Mass.
Riggs, Homer Chase, VI, '17 (B.T.E.). President, Riggs & Lombard, Inc., Lowell, Mass.
Ripley, George Keyes, II '17 (D). President, Troy Blanket Mills, Troy, N. H.
Rivers, William Anthony, II, '24 (D). Manager, Marlboro District, Metropolitan Life Insurance Company, Marlboro, Mass.
Roarke, John James, IV, '36 (B.T.C.). Textile Chemist, Geigy Company, 88 Broad Street Boston, Mass.
Robbins, Lucy Wiley, VI, '37 (B.T.E.). See Weinbeck, Mrs. John C.

Robbins, Walter Archibald, VI, '30 (B.T.E.). Assistant to Plant Engineer, Columbia Mills, Inc., Minetto, N. Y.
Roberson, Pat Howell, I, '05 (C). Vice-President, Union State Bank, Pell City, Ala.
Roberts, Carrie Isabel, IIIb, '05 (C). Craft Work, 161 Sayles Street, Lowell, Mass.
Robillard, Gerald Adelbert, IV, '33 (B.T.C.). Chemist and Salesman-Demonstrator, Canadian Industries, Ltd., Montreal, Que.
Robinson, Ernest Warren, IV, '08 (D). Manager, Line Division, The Shakespeare Company, Kalamazoo, Mich.
Robinson, Russell, VI, '21 (B.T.E.). Overseer, Warwick Mills, West Warwick, R. I.
Robinson, William Albert, II, '25 (D). Author and Explorer, 16 Chauncy Street, Cambridge, Mass.
Robinson, William Carleton, III, '03 (C). With Durand Shoe Company, Auburn, Maine.
Robson, Frederick William Charles, IV, '10 (D).
Rodalvicz, Francis Rudolph, IV, '28 (B.T.C.). Assistant Chemist, American Woolen Company, Wood Worsted Mills, Lawrence, Mass.
Rowntree, Clyde Burton, IV, '39 (B.T.C.). Textile Chemist, Pacific Mills, Worsted Division, Lawrence, Mass.
Royal, Louis Merry, VI, '21 (B.T.E.) Teacher of Mathematics, Pawtucket Senior High School, Pawtucket, R. I.
Rundlett, Arnold Dearborn, VI, '12 (D). Superintendent, Joseph Noone's Sons Company, Peterborough, N. H.
Runnells, Harold Nelson, IV, '25 (B.T.C.). 32 Franklin Street, Concord, N. H.
Russell, Harold William, VI, '32 (B.T.E.). In Charge of Testing and Research Laboratory, Goodall Worsted Company, Sanford, Me.
Russell, John William, IV, '20 (B.T.C.). Chemist, American Lanolin Corporation, Lawrence, Mass.
Russell, William Samuel, Jr., VI, '28 (B.T.E.). Textile Division Manager, Keasbey & Mattison Co., Ambler, Pa.
Ryan, David Louis, II, '27 (D). Sales Representative, Duplan Silk Corporation, 18 West Chelten Avenue, Philadelphia, Pa.
Ryan, Lawrence Francis, IV, '23 (B.T.C.). Textile Chemist and Demonstrator, E. I. du Pont de Nemours & Co., Inc., Technical Laboratory, Wilmington, Del.
Ryan, Millard Kenneth Thomas, Jr., II, '24 (D). 320 Vernon Road, Germantown, Philadelphia, Pa.
Ryberg, Bertil August, IV, '29 (B.T.C.), '36 (M.S.). Research Chemist, American Association of Textile Chemists and Colorists, Lowell Textile Institute, Lowell, Mass.

Sadler, Thomas Sheridan, II, '30 (D). With Southern Asbestos Company, Charlotte, N. C.
Sampson, Clifford William, IV, '28 (B.T.C.). Technical Director, Emery Industries, Inc., 4300 Carew Tower, Cincinnati, Ohio.
Sanborn, Frank Morrison, VI, '19 (B.T.E.). With Winnsboro Mills, Winnsboro, S. C.
Sanborn, Ralph Lyford, VI, '16 (B.T.E.). Purchasing Agent, Firestone Cotton Mills, Inc., Gastonia, N. C.
Sandlund, Carl Seth, VI, '25 (B.T.E.). Research, Propper-McCallum Hosiery Company, Northampton, Mass.
Sargent, Robert Edward, IV, '25 (B.T.C.). Chemist, Tubize Chatillon Corporation, Rome, Ga.
Sargent, Walter Ambrose, I, '22 (D). Instructor, Textile Shop Practice, Board of Education, Passaic, N. J.
Saunders, Harold Fairbairn, IV, '09 (D). 301 West 8th St., Coffeville, Kans.
Savard, Aime Albert, Jr., IV, '33 (B.T.C.). United States Finishing Company, Norwich, Conn.
Savery, James Bryan, II, '23 (D). Treasurer, Savery Manufacturing Company, Hartford, Conn.
Sawyer, Henry Severance, VI, '32 (B.T.E.). Treasurer, Sawyer, Regan Company, Dalton, Mass.
Sawyer, Richard Morey, VI, '27 (B.T.E.). (M.S., 1929, Massachusetts Institute of Technology.) Office Manager, Firestone Cotton Mills, Inc., Gastonia, N. C.
Scanlon, Andrew Augustine, IV, '26 (B.T.C.).
Schaetzel, André Paul, IV, '21 (B.T.C.). Chief Chemist, Aspinook Corporation, Jewett City, Conn.
Schneiderman, Jacob, III, '27 (D). Golf Professional, Mt. Pleasant Country Club, Leicester, Mass.
Schoelzel, Herman Walter, IV, '35 (B.T.C.). With Ayer Mill, Lawrence, Mass.

Schreiter, Ehrich Ernest Max, VI, '26 (B.T.E.). Industrial Sales Representative, Sun Oil Company, Revere, Mass.

Schwarz, Herman Louis, IV, '22 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., 61 Van Dam Street, New York City.

Scott, Gordon Maxwell, IV, '20 (B.T.C.). Finisher, Princeton Worsted Mills, Inc., Trenton, N. J.

Shaber, Hyman Jesse, VI, '17 (B.T.E.). M.B.A., 1922 Harvard Graduate School of Business Administration). Shoe Buyer and Merchandiser, J. S. Raub Shoe Stores, Wilkesbarre, Pa.

Shah, Kantilal Hiralal, VI, '36 (B.T.E.). Bombay, India.

Shah, Shantilal Hiralal, IV, '34 (B.T.C.). (M.B.A., 1936, Harvard Graduate School of Business Administration.) Bombay, India.

Shain, Joseph, IV, '35 (B.T.C.). Of Cowan & Shain, 280 River Street, Haverhill, Mass.

Shanahan, James Edward, II, '22 (D). With H. H. Butler Store, Amsterdam, N. Y.

Shananquet, Mrs. Lee (Woodies, Ida A.), IIIb, '00 (C).

Shann, William Edwin, II, '35 (D). Manufacturer, Glenbar Fabrics, Lowell, Mass.

Shapiro, Sidney, VI, '38 (B.T.E.). With Harry Strauss & Company, 66 Leonard Street, New York City.

Shapiro, Simon, VI, '34 (B.T.E.). Technical Assistant to President, Artcraft Silk Hosiery Mills, Philadelphia, Pa.

Shea, Francis James, II, '12 (D). 98 Pine Street, Florence, Mass.

Shea, John Francis, IV, '28 (B.T.C.). Demonstrator, Buffalo Electro-Chemical Co., Inc., 207 A Street, Boston, Mass.

Shedd, Jackson Ambrose, III, '28 (D). Superintendent, S. Stroock & Co., Inc., Newburgh, N. Y.

Sheehan, Leo James, IV, '38 (B.T.C.). 258 Merrimac Avenue, Dracut, Mass.

Shelton, Charles Leopold, VI, '29 (B.T.E.).

Shenker, Nahman, III, '25 (D). 50 East 18th Street, Brooklyn, N. Y.

Sidebottom, Leon William ,IV, '11 (D). Chief Chemist, Boston Blacking & Chemical Company, Cambridge, Mass.

Silberstein, Raymond, III, '39 (D). 1329 49th Street, Brooklyn, N. Y.

Sjostrom, Carl Gustof Verner, Jr., III, '17 (D).

Slamin, Alfred Francis, I, '26 (D). Sales Manager, Benjamin Franklin Paint and Varnish Company, Philadelphia, Pa.

Sleeper, Robert Reid, IV, '00 (D). Textile Chemist, Calco Chemical Division, American Cyanamid Company, Bound Brook, N. J

Smith, Allen Batterman, I, '26 (D). Turner Halsey Company, 40 Worth Street, New York City.

Smith, Doane White, II, '10 (D). 15 Oakland Street, Natick, Mass.

Smith, Frank Kenfield, II, '24 (D). Technician, Grout's, Ltd., St. Catharines, Ont.

Smith, Harold, IV, '34 (B.T.C.). 24 Belmont Street, Lowell, Mass.

Smith, Herbert Jeffers, VI, '22 (B.T.E.). Sales Representative, U. S. Ring Traveler Company, Providence, R. I.

Smith, Ralston Fox, I, '04 (C). Sales Manager, W. H. Warner & Co., 1708 Union Trust Building, Cleveland, Ohio.

Smith, Roger Dennis, II, '27 (D). Assistant Superintendent, M. T. Stevens & Sons Co. (Pentucket Mills), Haverhill, Mass.

Smith, Theophilus Gilman, Jr., IV, '10 (D). Farming, Groton, Mass.

Snelling, Fred Newman, II, '03 (D). With the American Railway Express Company, Haverhill, Mass.

Sokolsky, Henry, VI, '17 (B.T.E.). Time Study Supervisor, B. F. Sturtevant Company, Hyde Park, Mass.

Somers, Benjamin, II, '25 (D). 128 Pleasant Street, Brookline, Mass.

Sood, George David, IV, '38 (B.T.C.). Textile Tester, Research Laboratory, Slatersville Finishing Company, Slatersville, R. I.

Southwick, Charles Hudson, IV, '22 (B.T.C.). Assistant Dyer, Slatersville Finishing Company, Slatersville, R. I.

Spalding, Arthur Ovila, IV, '32 (B.T.C.). Technical Man on Wool and Worsted, Sandoz Chemical Works, Inc., New York City.

Spanos, James Peter, IV, '37 (B.T.C.). With Farr Alpaca Company. Holyoke, Mass.

Spevach, Edward, IV, '39 (B.T.C.). Spevach-Garbaccio, Inc., East Rutherford, N. J.

Spiegel, Edward, II, '03 (C).

Stacey, Alfred Charles, IV, '30 (B.T.C.). Chemist, Shoe Lace Company, Lawrence, Mass.

Standish, John Carver, IV, '11 (D). Superintendent, Albany Felt Company, Albany, N. Y.

Stanley, John Prince, Jr., IV, '29 (B.T.C.). Chemist and Overseer of Bleaching, Certified Laboratories, Inc., Austin, Texas.

Stass, John George, II, '27 (D). Textile Analyst, Better Fabrics Testing Bureau, 101 West 31st Street, New York City.

Steadman, Frank M., VI, '39 (M.S.). (B.S., U. S. Military Academy, 1929). Captain, Quartermaster Corps, U. S. Army, Officer in charge Research and Development Branch, Philadelphia Quartermaster Depot, Philadelphia, Pa.

Stearns, Kenneth Lawrence, IV, '33 (B.T.C.). Rayon Dyeing, Rayon Dye House, Pacific Print Works, Lawrence, Mass.

Steele, Everette Vernon, IV, '24 (B.T.C.). Purchasing Agent, Rohm & Haas Co., Inc., Philadelphia, Pa.

Stein, William Joseph, VI, '35 (B.T.E.). Textile Broker, Harry Strauss & Co., 66 Leonard Street, New York City.

Steinberg, Sidney, VI, '39 (B.T.E.). Assistant Superintendent, American Brand Textile Company, Passaic, N. J.

Stephens, Arnold George, I, '29 (D). With Wm. S. Haynes, 108 Massachusetts Avenue, Boston, Mass.

Stevens, Raymond Russell, IV, '19 (B.T.C.). Chief Chemist, The Felters Company, Inc., Millbury, Mass.

Stevens, William Edwin, I, '34 (D). With B. B. & R. Knight Corporation, (Royal Mill), River Point, R. I.

Stevenson, Murray Reid, III, '03 (C).

Stewart, Alexander, VI, '31 (B.T.E.). U. S. Commissioner of Conciliation, U. S. Department of Labor, Washington, D. C.

Stewart, Arthur Andrew, II, '00 (D). Professor of Textiles; in charge of Finishing Department, Lowell Textile Institute, Lowell, Mass.

Stewart, John Weeden, IV, '30 (B.T.C.). Laboratory Foreman, General Dye-stuff Corporation, 435 Hudson Street, New York City.

Stewart, Walter Lawrence, III, '03 (D).

Stiegler, Harold Winfred, IV, '18 (B.T.C.). (M.S., 1922, Ph.D., 1924, Northwestern University.) Head of Textile Division, American Cyanamid Company, Stamford, Conn.

Stohn, Alexander Charles, III, '06 (C). Factory and Production Manager, Carl Stohn, Inc., East Taunton, Mass.

Stolzberg, Howard Nathaniel, IV, '35 (B.T.C.). Chemist and Owner, Jaybee Chemical Company, Haverhill, Mass.

Stone, Ira Aaron, IV, '09 (D). Vice-President, Royal Manufacturing Company, Charlotte, N. C.

Storer, Francis Everett, II, '07 (D). Meredith, N. H.

Storey, Alvin Briggs, VI, '28 (B.T.E.). Assistant Textile Superintendent, Celanese Corporation of America, Cumberland, Md.

Stott, John Smith, III, '28 (D). With Newmarket Manufacturing Company, Lowell, Mass.

Stowell, Eldon, A.B., I, '39 (D). Engineer, Sales Development Department, American Viscose Corporation, Marcus Hook, Pa.

Stronach, Irving Nichols, IV, '10 (D). Superintendent, Hampton Company, Easthampton, Mass.

Strout, Kenneth Edward, III, '28 (D). Designer, American Mills Company, New Haven, Conn.

Sturtevant, Albert William, IV, '17 (D). Automobile Mechanic, Lowell Motor Sales, Inc., Lowell, Mass.

Sturtevant, Fred William, IV, '26 (B.T.C.). Chemist, Naugatuck Chemical Division, United States Rubber Products, Inc., Naugatuck, Conn.

Suhlke, Waldo Eric, IV, '20 (B.T.C.). Teacher, Jefferson Junior High School, Meriden, Conn.

Sullivan, John David, VI, '12 (D). With Robert Gair Company, Bradford, Mass.

Sullivan, Lambert William, II, '23 (D). Instructor in Textiles, Massachusetts Reformatory, West Concord, Mass.

Sullivan, Willard David, II, '23 (D). Breene's Store, Lowell, Mass.

Sunbury, Herbert Ellsworth, VI, '18 (B.T.E.). Works Manager, Asbestos Textile Company, Inc., North Brookfield, Mass.

Sung, Harvey Chih, VI, '37 (B.T.E.). Tientsin, China.

Sutcliffe, Henry Mundell, II, '25 (D). Second Hand, Webster Mills, Webster, Mass.

Sutton, Leslie Emans, I, '17 (D). Manager, Anniston Cordage Company, Anniston, Ala.

Swain, Harry LeRoy, Jr., I, '26 (D). Purchasing Department, Firestone Tire & Rubber Co., Akron, Ohio.

Swan, Guy Carleton, II, '06 (D). Chemist, U. S. Department of Agriculture, 201 Varick Street, Room 1200, New York City.
Swanson, John Harold, I, '28 (D). Assistant Superintendent, Georgia-Kincaid Mills, Griffin, Ga.
Sweeney, George Hamilton, II, '24 (D). Salesman, Walker Stetson Company, 147 Essex Street, Boston, Mass.
Swift, Edward Spooner, S. J., I, '02 (D). Clergyman, Church of the Immaculate Conception, Boston, Mass.
Syme, James Francis, II, '00 (D). West Yarmouth, Mass.
Symmes, Dean Whiting, IV, '22 (B.T.C.). Salesman and Demonstrator, National Aniline and Chemical Company, 150 Causeway Street, Boston, Mass.

Tamulonis, Edward William, VI, '30 (B.T.E.). In charge of Production and Scheduling, Newmarket Manufacturing Company, Lowell, Mass.
Tang, Hsiung-Yuan, I, '30 (D). Assistant Manager, Sung Sing Cotton Mill, No. 3. Vice President & Works Manager, Yih Hsing Woolen & Worsted Mills, Wusih, Kiangsu, China.
Tarpey, Thomas Joseph, IV, '27 (B.T.C.). 23 Fremont Street, Somerville. Mass.
Tarshis, Elias Aaron, IV, '28 (B.T.C.).
Teague, Charles Baird, II, '26 (D). Civil Engineer, Highway Division, Massachusetts Public Works Department, Boston, Mass.
Thaxter, Joseph Blake, Jr., II, '12 (D). Sales Executive, Ludlow Manufacturing & Sales Corporation, 211 Congress Street, Boston, Mass.
Thomas, Benjamin, Jr., VI, '34 (B.T.E.). Overseer, Jackson Mills, Nashua, N. H.
Thomas, Robert Joseph, IV, '34 (B.T.C.). (M.S., 1937, University of Notre Dame). Research Chemist and Colorist, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del.
Thomas, Roland Vincent, I, '05 (C). With Chicopee Sales Corporation, 40 Worth Street, New York City.
Thompson, Arthur Robert, Jr., IV, '22 (B.T.C.). Salesman, Ciba Company, Inc. Charlotte, N. C.
Thompson, Everett Leander, I, '05 (D). 53 Morse Avenue, Brockton, Mass.
Thompson, George Robert, IV, '35 (B.T.C.). Chemist, United States Finishing Company, Providence, R. I.
Todd, Walter Ernest, III, '23 (D). Resident Agent, Metropolitan Life Insurance Company, Uxbridge, Mass.
Toepler, Carl, IV, '22 (B.T.C.). Supervisor Permanent Finish Department, Bellman Brook Bleachery Company, Fairview, N. J.
Toher, Francis Luke, IV, '32 (B.T.C.). In Charge of Dyeing, Lebanon Knitting Mill Company, Pawtucket, R. I.
Topjian, Leon, IV, '30 (B.T.C.). 416 Massachusetts Avenue, Boston, Mass.
Toshach, Reginald Alexander, II, '11 (D). Proprietor, Toshach's Mill Remnants Haverhill, Mass.
Toupin, Stephane Frederick, VI, '24 (B.T.E.). Plant Engineer, Regent Knitting Mills, Ltd., St. Jerome, Quebec.
True, William Clifford, II, '22 (D). Assistant Superintendent, Ludlow Manufacturing & Sales Co., Allentown, Pa.
Turcotte, David Henry, IV, '33 (B.T.C.). 33 Ellis Avenue, Lowell, Mass.
Tyler, Bernard James, IV, '36 (B.T.C.). Textile Testing, United States Testing Company, Hoboken, N. J.
Tyler, Lauriston Whitcombe, II, '16 (D). Manager, W. T. Grant Company, Brunswick, Me.

Valentine, Burnet, VI, '23 (B.T.E.). Department Manager, Pepperell Manufacturing Company, 40 Worth Street, New York City.
Valentine, Preston Sumner, IV, '36 (B.T.C.). With American Seal-Kap Corporation, Long Island City, N. Y.
Vaniotis, Socrates Vasilios, IV, '37 (B.T.C.). Shelton Looms, Shelton, Conn.
Varnum, Arthur Clayton, II, '06 (D). South Lyndeboro, N. H.
Villa, Luis Jorge, IV, '25 (B.T.C.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.
Villa, William Horace, VI, '24 (B.T.E.). Technical Director, Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.
Villeneuve, Maurice Arthur, II, '26 (D). With Killingly Worsted Mills, Danielson, Conn.
Vincent, William Henry, III, '26 (D). 18 Albion Street, Hyde Park, Mass.

Wagner, George Frederic, Jr., VI, '38 (B.T.E.). Assistant Superintendent, Oxford Looms, Inc., Oxford, Mass.
Walen, Ernest Dean, VI, '14 (B.T.E.). Agent and Merchandise Manager, Pacific Mills (Worsted Division), Lawrence, Mass.
Walker, Alfred Schuyler, II, '11 (D). 67 Park Avenue, Saranac Lake, N. Y.
Walker, Anna Gertrude, IIIb, '03 (C). See Pradel, Mrs. Alois J.
Walker, Raymond Scott, II, '23 (D). Production Superintendent, Arlington Mills, Lawrence, Mass.
Walker, Samuel J., IV, '32 (B.T.C.). Analyst, National Association of Dyers and Cleaners, Silver Springs, Md.
Wallace, Joseph Max, IV, '31 (B.T.C.). With Enequist Chemical Company, 255 Freeman Street, Brooklyn, N. Y.
Wang, Chen, IV, '23 (B.T.C.).
Wang, Cho, VI, '23 (B.T.E.).
Wang, Tung Chuan, VI, '23 (B.T.E.).
Wang, Yun-Cheng, VI, '31 (B.T.E.). Assistant Manager, Sung Sing Cotton Mill No. 1, Shanghai, China.
Wang, Yung Chi, II, '21 (D).
Ward, George Chester, IV, '28 (B.T.C.). Research Chemist, Celanese Corporation of America, Cumberland, Md.
Warren, E. Maybelle, IV, '28 (B.T.C.). Chemist, Hub Hosiery Mills, Lowell, Mass.
Warren, Philip Hamilton, II, '05 (D). Superintendent, Hopeville Manufacturing Company, Worcester, Mass.
Washburn, John Milton, Jr., IV, '21 (B.T.C.). Salesman, Colgate-Palmolive-Peet Company, Boston, Mass.
Watson, William, III, '11 (D). Real Estate, Frank E. & Wm. Watson, 50-54 Merrimack Street, Haverhill, Mass.
Webber, Arthur Hammond, IV, '01 (D). In Charge of Color Department, Richard Young Company, Peabody, Mass.
Webster, Joseph Albert, VI, '23 (B.T.E.). Technical Assistant to General Manager, Stehli & Company, Inc., Lancaster, Pa.
Weinbeck, Mrs. John C. (Robbins, Lucy W.), VI, '37 (B.T.E.). 102 South Loring Street, Lowell, Mass.
Weinstein, Edward Joseph, VI, '25 (B.T.E.). Harrison Hardware Company, Harrison, N. Y.
Welch, William Paul, Jr., IV, '36 (B.T.C.). 39 Ware Street, Lowell, Mass.
Wells, Ai Edwin, VI, '20 (B.T.E.). (Ed.M. 1937, Boston University.) Assistant Professor, Textile Engineering Department, Lowell Textile Institute, Lowell, Mass.
Wells, Henry Alfred, Jr., IV, '33 (B.T.C.). Night Overseer of Printing, Ware Shoals Manufacturing Company, Inc., Ware Shoals, S. C.
Westaway, John Chester, VI, '28 (B.T.E.). Secretary-Treasurer, W. J. Westaway Co., Ltd., Hamilton, Ont., and Vice-President, Sonoco Products Company of Canada, Ltd., Brantford, Ont.
Westbrooke, Clayton Collington, IV, '29 (B.T.C.). Chemist, Bigelow-Sanford Carpet Company, Thompsonville, Conn.
Wetherbee, Francis Putney, I, '28 (D). Flint River Cotton Mills, Albany, Ga.
Wheaton, Walter Francis, VI, '23 (B.T.E.). Stationer, Walter F. Wheaton, White Plains, N. Y.
Wheelock, Silas Mandeville, Jr., II, '39 (D). With Uxbridge Worsted Company, Inc., Uxbridge, Mass.
Wheelock, Stanley Herbert, II, '05 (D). President and Treasurer, Stanley Woolen Company, Uxbridge, Mass.
Whitcomb, Roscoe Myron, IV, '10 (D). Druggist, The Rexall Store, Ashland, N. H.
White, Royal Philip, II, '04 (D). Resident Manager, American Woolen Company (Vassalboro Mills), North Vassalboro, Me.
Whitehill, Warren Hall, IV, '12 (D). Overseer of Dyeing, Pacific Mills, Worsted Department, Lawrence, Mass.
Wiech, Raymond Edward, IV, '29 (B.T.C.).
Wiesner, Arthur Charles, II, '39 (D). With Rhode Island Worsted Company, Stafford Springs, Conn.
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Wilkie, Robert Campbell, VI, '34 (B.T.E.). Research Engineer, Pacific Mills, Lawrence, Mass.
Wilkinson, Herbert William, Jr., IV, '37 (B.T.C.). Technical Director, Southbridge Finishing Company, Southbridge, Mass.

Williams, Albert William, III, '32 (D). Designer, Manhattan Shirt Company, New York, N. Y.

Williamson, Douglas Franklin, I, '22 (D). Assistant to General Superintendent, Granite Falls Manufacturing Company, Granite Falls, N. C.

Wilman, Rodney Bernhardt, II, '25 (D). Superintendent, New England Fibre Blanket Company, Worcester, Mass.

Wilson, Raymond Bachman, II, '36 (D). With International Narrow Fabric Company, Keene, N. H.

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DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

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CALENDAR.

1940.

September 26, Thursday	Registration.
October 3, Thursday	Registration.
October 7, Monday	Opening of evening school.
October 12, Saturday	Columbus Day—Holiday.
November 11, Monday	Armistice Day—Holiday.
November 28, Thursday	Thanksgiving—Holiday.
December 20, Friday	End of first term.

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January 6, Monday	Opening of second term.
March 7, Friday	Closing of evening school.
April 3, Thursday	Graduation.

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain

knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

111. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made.

Two evenings each week.

Cotton.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cotton desired and securing delivery at a known price.

Opening and Picking.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doub-

lings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

Roving.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

Ring Spinning.—A study of the various types of yarns gives the student an appreciation of the necessary characteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studied in detail. Important machine parts, such as rings, builders, guides and travelers, their adjustment and care, form an important part of this subject. Yarn faults and defects are shown and their causes explained.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

113. Knitting—1 Year.

This is a general course on the manufacture of knitted fabrics and garments, intended for those interested in the principles of knitting and a study of the mechanisms of a variety of knitting machines. The more important phases of the course are:—

Yarns and Yarn Sizing Systems.—In order that the student may understand the distinctions between yarns, terminology, and the various sizing systems commonly used, several lectures are devoted to yarn characteristics and sizing as a basis for the entire course. This covers cottons, woolens, worsteds, silks and rayons.

Flat Machines.—These relatively simple machines make a fine starting point in establishing clearly the action of the latch needle and how it is operated. Lamb, Dubied, Grosser, and Links and Links machines are used as a basis for this part of the work.

Small Circular Ribbers.—These machines are a very logical step, following flat machines. Brinton, Wildman, and Universal ribbers, with different pattern mechanisms, are used in illustrating this type of work.

Automatic Hosiery Machines.—This section of the course is built around the various Banner and the Scott and Williams half and full hose machines. Most of the work is done with the plain machines as there is not sufficient time to include the fancy pattern type.

Large Ribbers and Spring Needle Machines.—Underwear fabric and webbing are produced on this type of equipment. Scott and Williams, Wildman and Crane machines are the basis for instruction along these lines.

Full Fashioned Machine.—A brief study of the full fashioned principles and actions is based on the Reading 18-section machine in the laboratory.

Warp Knitting.—Using the Raschel machine in the laboratory, a general study of warp knitting includes Tricot and Milanese work also.

Analysis.—During the study of the various machines, considerable attention is given to the many "stitches" possible. This, coupled with the lectures on fabric and hosiery analysis, covers the common analysis problems.

Routines.—The usual sequence of manufacturing processes for hosiery and underwear are studied with the idea of illustrating the steps necessary in producing different articles.

Most of the instruction in this course is given by lectures. As many of these machines are small, it is common practice to bring the machine under discussion into the classroom so that students may see the machine and parts being considered. In other instances, the class may go into the laboratory to see the equipment and its operation.

114. Cotton Organization—1 Year.

This course, offered only to those who have completed the work in Carding and Spinning, is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

211. Woolen Yarns—1 Year.

Instruction consists of lectures on technology of wool fiber (for detailed description see Course 217) and woolen yarn manufacture. This covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Reworked fiber (shoddy) is covered in detail from rag sorting to finished staple.

Three evenings each week.

217. Wool and Top Making—1 Year.

Instruction consists of lectures in technology of wool fibers, worsted carding and combing, and mechanism and calculations.

Technology of Wool Fibres—*one evening each week.*

Raw Materials.—The study of raw materials which enter into the manufacture of woolen or worsted yarns or hardened felts, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel hair, cut staple rayon, etc. In connection with these are considered shoddy, noils, and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lectures. The various characteristics and properties are explained, as are also trade terms, such as Fine, ½-blood, ⅜-blood, 56^s, 36^s, B super, delaine, braid, etc. Over 1,500 samples of wool and other fibers gathered from all the countries of the world are catalogued and are available for inspection and study. Wool shrinkages are studied as are also spinning qualities. A complete collection of literature pertaining to sheep, wool, etc. is available for outside reading or study.

Wool Scouring.—The objects of scouring or degreasing and the methods employed are explained. This involves the consideration of soaps and chemicals used in scouring and degreasing, also the waste products and their utilization. A sorted lot of grease wool is scoured by machines that are made similar in operation to regular commercial wool scouring machines. At the same time the use of driers, their operation and regulation, is taken up.

Carbonizing.—The methods of carbonizing wool, noils, burr waste, rags, etc. are studied. If time permits, a commercial quantity of stock is carbonized on the regulation carbonizing machines in the wool laboratory.

Worsted Carding and Combing—*one evening each week.*

Carding.—The different types of worsted cards are studied in detail, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application, grinding, setting, etc.

Combing.—This branch takes up the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and Noble comb is studied by lectures. Two Noble combs are available for inspection and study.

Mechanism and Calculations—*one evening each week.*

This subject gives the principles of the various mechanisms used in wool manufacturing machines. Among the topics dealt with are—equations, surface speed, R. P. M., drivers, drivens, draft and production calculations, stop motions, combing layouts, levers, logarithms, top testing, calculations, etc.

218. Worsted Yarns—1 Year.

Instruction is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule or frame. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

219. Air Conditioning—2 Years.

The subjects covered in this course include the following; fundamental laws, principles and definitions; physical properties of the atmosphere; explanation of words and terms used, such as—matter, energy, heat, heat energy, temperature, ice, water, vapor, gas, steam, thermometers, hygrometers, hydrometers, barometers, pressure, gage pressure, absolute pressure, absolute temperature, laws of gases, heat units, vapor pressure, dew point, evaporation, condensation, precipitation, relative and absolute humidity; sensible heat, latent heat, specific heat, total heat of air, effective temperature, comfort zones, air movement, ventilation; movement of heat and air, infiltration, conduction, solar heat, air breakage; heat from human beings; lights, machinery and processes; humidification and dehumidification, heating and cooling, air filtration, air washing; refrigeration and refrigerants, cooling by water, ice, typical air-conditioning equipment, typical control equipment, thermostats, humidostats, wet and dry bulb type; use of charts and tables, costs, etc.

Students are required to hand in complete details for producing prescribed conditions of temperature and humidity in some building in or near Lowell, Mass., before completing the course.

One evening each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern,

are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be. The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quilting, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313. Decorative Art—3 Years.

The first year work consists of charcoal drawing from plaster models and group arrangements of still life for ten weeks. The second ten weeks deals with pastel drawing of still life groups.

Two evenings each week.

During the second year instruction is given in color harmony—a study of color and variety of effects obtainable.

Two evenings each week.

In the third year the student chooses one of the following options:

1. Life Drawing—drawing from model.
2. Painting—either in oils or water color of still life groups.
3. Perspective—a study of the mechanical approach to correct drawing.

Two evenings each week.

314. Show Card Design—2 Years.

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with

the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.

Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

Theoretical Chemistry.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

Non-Metallic Elements.—Study of their occurrence, properties, preparation, chemical compounds, etc.

Metallic Elements.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Artificial Fibers.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods of detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.
Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

ENGLISH DEPARTMENT

511. English Composition—2 Years.

First Year.—Remedial English and Rhetoric.—In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing in a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles. The course of instruction consists of lectures, recitations, remedial exercises, and the study of a text book.

One evening each week.

Second Year.—The Principles of Composition.—This is an advanced course and is not open to students who have not completed the first year or its equivalent. The primary purpose of this course is to give the student the ability to write clearly and correctly. An intensive study is made of the four divisions of composition—narration, description, exposition, and argumentation— and the art of letter writing. Selections from various authors to be read for general interest and for the purpose of illustration, are assigned for outside reading. Lectures are given; and home work, the study of a text book, and examinations are required.

One evening each week.

512. Appreciation of Literature—1 Year.

This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

Two evenings per week.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, Shop Mathematics, Mechanics, and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

Two evenings each week.

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horse-power, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires home problem work and the study of a text book.

Two evenings each week.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

Two evenings each week.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

Two evenings each week.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on

such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

Two evenings each week.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. A considerable amount of home study and preparation is required. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

Two evenings each week.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work.

Two evenings each week.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated. A text book is required.

Two evenings each week.

626. Mill Illumination—1 Year.

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

Two evenings each week.

628. Selling and Advertising—1 Year.

This course covers the basic principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

Two evenings each week.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears,

gearing, cams and similar topics. Home problem work and the study of a text book are required.

Two evenings each week.

631. Plane Geometry—2 Years.

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

Two evenings each week.

632. Diesel Engines—1 Year.

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

Two evenings each week.

633. Shop Mathematics—1 Year.

This subject deals with the practical application of mathematics which is of the greatest use to machinists or those in similar lines of work. It consists of those parts of arithmetic, algebra, geometry and trigonometry, which are essential in modern machine shop practice. Some of the topics are:—fractions and decimals, logarithms, problems in ratio and proportion, areas of surfaces, calculation of angles, solution of right and oblique triangles.

In addition to the mathematical work, the scientific principles which govern the operation of various machines are studied. In this connection the following topics are included:—verniers and micrometers, levers, belt and gear speeds, screw threads and screw cutting, gear tooth computations, plain and differential indexing. This subject requires home problem work and the study of a textbook.

Two evenings each week.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double

cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

FULLING.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

WASHING AND SPECK DYEING.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

CARBONIZING.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

GIGGING, NAPPING AND STEAMING.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

BRUSHING, SHEARING AND PRESSING.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1940.

Certificates awarded as follows, April 3, 1940:

Cotton Yarns—Two Years

ıgar Ludger Burelle, Nashua, N. H.
uel Arthur MacLaughlin, Lowell
ıssell Carter Noyes, Manchester
Robert Homer Smith, Nashua, N. H.
Foris Vernon Welch, Nashua, N. H.

Knitting—One Year

bert George Bonin, Lowell
Stanley Oczkowski, Chelmsford

Wool and Top Making—One Year

orris Redmond Crocker, Westford
ank Ralph Curtin, Andover
nneth Edmund DeLaHaye, Forge Village
vin DeRoche, Lawrence
fred Greenfield, Jr., Andover
rcival Frederick Grenville, Methuen
el Douglas Hoyt, Methuen
ctor Paul Johnson, Westford
ıymond Maxime Lafortune, Lowell
Edward Paul Law, Worcester
Peter Makey, North Chelmsford
Charles Thomas Midolo, Lawrence
Walter John Miranowicz, Lawrence
Emil Peter Pacula, Lowell
John Harvey Ramsey, North Chelmsford
Arnold Paul Romanowsky, Lowell
John William Scriven, 3rd, Arlington

Worsted Yarns—One Year

mes John Caires, Cambridge
thur Bernard Charlesworth, Methuen
ncent John Connell, Lawrence
bert Vincent Cote, Lawrence
lward Lorenzo Hapshe, Lawrence
seph Augustine Hicks, Lawrence
Rene Lionel Lacharite, Lawrence
Walter Stoddart MacLauchlan, Methuen
Robert Lee Mack, Winthrop
Vincent John Noble, Methuen
Anthony Peter Palermo, Lawrence

Woolen Yarns—One Year

ederick Belmer Belanger, Haverhill
milton Charles Bickford, North Billerica
ıy Eugene Branch, Lowell
thur James Broderick, North Andover
bert Keith Lyle, Lowell
George Washington Pihl, Lowell
William Plunkett Rockwell, North Andover
Davis Simpson, South Hamilton
Arthur Norris Thompson, Chelmsford
Patrick Joseph White, Lowell

Cotton Design—Three Years

niel Maurice Hill, Roxbury
man Burns Hunter, Salem
ıelia Lyko, Lowell
onislaw Peter Prokuski, Manchester, N. H.
Kenneth Henry Sennett, Chelsea
Oscar Raymond Sirois, Lawrence
Stanley Gordon Thwing, West Chelmsford
John Henry Zalis, Canton

Woolen and Worsted Design—Three Years

orge Sykes Archer, Lowell
lliam Edward Batty, Methuen
thur Edgar Cate, Lawrence
rry Eugene Conroy, Lawrence
lliam Sherman Curley, West Concord
arles Patrick Doonan, Andover
ıno Stanley Dzioba, Lawrence
ılter Henry Graichen, Methuen
lliam Aloysius Carol Kulpinski, Lawrence
ırtin John Lawlor, Jr., North Andover
Harry Washington Lebair, Jr., Lowell
Charles Thomas Neild, Lowell
Winford Sykes Nowell, Methuen
Raymond Atkinson Pearson, Methuen
Robert Howes Proctor, Andover
John Sefton Ramskill, Methuen
Donald Fairgrieve Richardson, Methuen
Richard Albert Robinson, Methuen
Edward Rosario Roy, Lawrence
George Olney Steere, Methuen

Show Card Design—Two Years

ıry Abodeely, Lowell
ginia Daggett, Lowell
ward Alexander Dery, Lowell
Ernest Gillibrand, Lowell
Gertrude Ruth Orrell, Lowell

Decorative Art—Three Years

Rita Margaret Coffey, Lowell
John Eugene Galipeau, Nashua, N. H.
Harold Frederick Hill, Lawrence
Mary Margaret Hoellrich, Lawrence
Leo Charles Urban, Lowell
Electra Fotaine Vlahos, Lowell

Cotton Weaving—One Year

Robert Boit Burnham, Brookline
Thomas Harvey McCann, Lowell

Woolen and Worsted Weaving—One Year

John Ernest Allison, North Andover
Robert Francis Beauchesne, Lowell
Charles James Benson, Lawrence
Ernest Augustus Borden, Bradford
Herbert Russell Chamberlain, Lawrence
Roger George D'Amour, Lowell
Ernest Wilfrid Dube, Lowell
Joseph Fuad Fram, Methuen
Stephen Francis Garbaczewski, Lawrence
John James Gillis, Lowell
Lionel Gustave Gregoire, Lowell
Valmore Roger Gregoire, Lowell
Warren Cleveland Hall, Andover
George Alfred Headley, North Andover
William John Krupa, Lawrence
Samuel Royce McMaster, Lowell
Walter Freeman Manahan, Lowell
Walter Michaud, Methuen
James Joseph Missett, Methuen
Thomas Bernard Murray, Lawrence
Donald Chetwynd Porter, North Andover
William Josef Provencher, Lowell
Richard William Paul Schreiber, Andover
Thomas Soucy, Jr., Lowell
Omer Armand Tellier, Lowell

Loom Fixing—One Year

Donat Joseph Beliveau, Jr., Lawrence
Joseph Antoine Bernier, Lowell
Andrew Blasik, Manchester, N. H.
Ralph Isaac Collinson, Lawrence
Samuel Royce McMaster, Lowell
Joseph Amy Martin, Lowell
Albert Joseph Morin, Jr., Lowell
James Chadwick Oliver, Lowell
Maurice Ligouri Sirois, Lowell
Thomas Soucy, Jr., Lowell
Lionel Donat Turcotte, Lowell

Woolen and Worsted Finishing—One Year

Sam Rosario Benigno, Andover
William Francis Boyd, Lowell
Oliver Damon, North Billerica
Frederick Darlington, Methuen
John Aelred Hughes, West Medford
M. Joseph Hughes, West Medford
Peter Kiberstis, Methuen
Shannon Mooradian, Haverhill
Amos Allen Stackpole, Lowell
Horace Nathaniel Stevens, Jr., North Ando
Gilbert Kingsley Switzer, Wellesley
William Maxwell Thomson, North Andov
Thomas Nicholson Ward, Methuen
Herbert Ernest Wieland, Lawrence

English Composition—Two Years

Sarah Berg, Lowell
Claire Cayer, Lowell
Virginia Cunningham, Lowell
Rose Alma Favreau, Lowell
Lauretta Marie Guilbeault, Lowell
Doris Louise Hadley, Lowell
Caroline Frances Kus, Lowell
Barbara Ellen Moran, Lowell
Agnes Gertrude Quinn, Lowell
Josephine Liddy Saulnier, Lowell
Anna Sophie Sudol, Lowell
Annette Elianne Tartre, Lowell
Alice Mary Wholey, Lowell
John Harry Zantuhos, Lowell

Appreciation of Literature—One Year

Linda Weinbeck Darby, Lowell
Helena Joan Fish, Lowell
Alice Marie O'Brien, Lowell
Margaret Patricia Sheedy, Lowell
Thomas Francis Sheehan, Lowell
Nancy Agnes Turnbull, Lowell

Elementary Chemistry—Two Years

Edwin Ralph Biron, Lowell
Alphonse Thomas Hatem, Methuen
Mildred Claire Hickey, Lowell
Edward Joseph LaBelle, Lowell
Joseph Edward Larochelle, Methuen
Armand George Lizotte, Amesbury
James Frederick Morgan, Lawrence
Mildred Ruth Navas, Lawrence
Harry Francis Seuss, Nashua, N. H.
Warren Archer Silva, Medford
Ernest Malcolm Stromvall, Jr., Lowell
Robert Sherman Weiner, Lowell
Elwood Augustus Whittemore, Jr., Lawrer

Textile Chemistry and Dyeing—Three Years

'alter Akam, Methuen
orman Ashton, Methuen
ernard Charles Jackson, Methuen
Francis Elmer Mosher, Lawrence
Armand Joseph Patenaude, North Chelmsford
Alfred Walter Scheer, Nashua, N. H.

Direct Current Electricity—Two Years

'illiam Francis Cain, Lawrence
ohn Vincent Carney, Jr., Lawrence
'arren Carl Caton, North Chelmsford
eorge Bernard Fallon, Jr., Lawrence
obert Patrick Gilmore, Nashua, N. H.
lbert Joseph Goguen, Andover
Francis William Hogan, Lowell
William Franklin Huntley, Lowell
Cedric Daniel Kinch, North Chelmsford
Melvin Joseph LaRivee, Lawrence
Paul Richard Pelletier, Nashua, N. H.

Alternating Current Electricity—Two Years

obert Ellsworth Clarke, North Reading
'alter Stanley Donzila, Lawrence
larence Everett Foster, Dracut
Francis John Hopkins, Lowell
Alexander Joseph Kotarba, Lowell
Raymond Thomas McDonagh, Lowell

Mathematics—Two Years

ustin Porter Bent, Billerica
'alter Stanley Donzila, Lawrence
hris John Economou, Lowell
lexander Joseph Graham, Lowell
rnest Leslie Hall, Jr., Lawrence
obert George Hewson, Methuen
ary Eva Jesus, Lowell
'alter Joseph Jurczak, Lawrence
Ralph Chandler Marden, Jr., Reading
John Francis Moynihan, Lawrence
Philip Archibald Scott, Jr., Billerica
Harry Nicholas Treaftis, Lowell
Raymond Francis Vennard, North Chelmsford
John Constantine Vurgaropulos, Lowell
Thaddeus Anthony Zabierek, Lowell

Mechanical Drawing—Three Years

arvey Milton Belyea, Lowell
erbert Foster Bowen, Lowell
aymond Alcid Damon, Dracut
aymond Joseph Demers, Lowell
aymond Henry Gearin, Lowell
aymond Ralph Harrison, Lowell
rthur Dean Hird, Lowell
Harold Kaye, Wilton, N. H,
Warren Axel Lofstrand, Lowell
John William Lough, Lawrence
Francis John Murphy, Lowell
Charles Ormond Palmer, Westford
Armand Ratte, Methuen
Fred Louis Winkley, Andover

Machine Shop Practice—Two Years

onald Robinson Bagley, Hudson, N. H.
uido Carlos Belli, Lowell
rnest Joseph Boisvert, Lowell
ouis Joseph Chaisson, Lowell
ngelo Dirubbo, North Chelmsford
mes Joseph Fitzgerald, Amesbury
uy William Franklin, Milford, N. H.
ndrew Gatto, Milford, N. H.
hilippe Alphonse Goyette, Lowell
ichael John Grimolizzi, Lowell
John Michael Gustartis, Methuen
Armand Robert Houle, Amesbury
Wilfred Lionel Houle, Amesbury
Raymond Louis Huard, Haverhill
Richard Reinhard Martin, Lawrence
Alphonse Joseph Picard, Amesbury
Paul Joseph Portelance, North Billerica
John Smith Ross, Milford, N. H.
William Leslie Sinton, North Chelmsford

Selling and Advertising—One Year

onel Joseph Beaulieu, Methuen
arguerite Hope Burke, Lowell
arie Frances Cahill, Lowell
anley Waterman Carpenter, Lowell
onstance Dorothy Caverly, Lowell
mile Joseph Ciemirkiewicz, Lawrence
harles Wilbur Davis, Lowell
lara Dayton, Lowell
obert Owen Donohoe, Lowell
rancis Joseph Earley, Lowell
orman Edgar Floris, Methuen
ohn Henry Foley, Lowell
ohn Gardner, Lowell
Walter Frank Jardis, Lawrence
John Thomas Lahan, Jr., Methuen
Roger Gerald Moberg, Lowell
Eileen Genevieve Molloy, Lowell
Emanuel Naparstek, Lowell
Joseph Ernest Ouellette, Lowell
Lionel Louis Patenaude, Lowell
Peter Sechovich, Forge Village
Raymond Howard Shepard, Lowell
Howard Francis Steeves, Lowell
Mary Ann Turner, Lowell
Elizabeth Varnum, Lowell
Foster Dennison Zink, Andover

Diesel Engines—One Year

George John Bannan, Lowell
Edmund Corkery, Lowell
Lionel Philip Ducharme, Lowell
Robert Ellery Fogg, Lowell
Henry Emile Gallant, Lawrence
George Victor Gilinson, Lowell
Stanley Joseph Grochmal, Lowell
George Willis Ham, Milton
Robert Joseph Hilbert, Lawrence
Carl Benjamin Laidlaw, Lowell
Raymond Elphege Proulx, Lowell
Chester Earl Ranlett, Lowell
Paul Theodore Savage, Lowell
William Francis Schaefer, Jr., Lowell
Frank Peter Smigelski, Collinsville
William Henry Stacey, Lowell
John William Trainor, North Billerica
Howard Varnum Walsh, Dracut

Steam—One Year

Edgar Charles Bonsaint, Lawrence
John Leonard Brain, Methuen
Kenneth Woodrow Brousseau, North Andover
Joseph Arthur Clarke, Lowell
Charles James Cullinan, Lowell
Thomas Francis Eastwood, Lawrence
James Shields Johnston, Lowell
Solomon August Kivimaki, Tyngsboro
Ernest Anthony Tesoro, Lawrence

Shop Mathematics—One Year

William George Ayotte, Jr., Lowell
Leslie Deaquilla Binks, Hudson, N. H.
Raymond Andrew Chateauneuf, Lowell
William Henry Ciardello, Methuen
Michael Andrew Keohane, Lowell
Stanley John Olszewski, Lowell
Robert Emery Paquin, Lowell
John Joseph Smith, North Chelmsford

Air Conditioning—Two Years

Lucien Joseph Cote, Lowell
Raymond Roscoe Curtis, Lowell
Leonard Roger Donnelly, Lowell
Robert Leavitt Gourley, Lowell
Luther Brannan Hilton, North Chelmsford
Arthur Gerhard Hjelmberg, Allston
Walter Stanley Kowalski, Dracut
Sylvester Thomas McDonagh, Lowell
Rudolph Augusta Mackie, Lowell
Edward Harold Quinlan, Lowell
Lawrence Talantzy, Graniteville

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A STUDY OF THE INFLUENCE, IN GILLING, OF CHANGES IN DRAFT AND UNCONTROLLED DISTANCE, UPON THE PROPERTIES OF ENGLISH PROCESSED WORSTED YARNS AND FABRICS MADE FROM NOBLE COMBED TOP.

By John C. Lowe, B.T.E., M.S., Assistant Professor of Textiles

The purpose of this paper is to present a report of two theses which have been prepared under the direction of Professor Herbert J. Ball, in charge of the Textile Engineering Department.

The material for the yarn experiments is selected from the graduate thesis by John C. Lowe, M.S. 1940, and that for the fabric experiments is from the undergraduate thesis by Henry E. Thomas, B.T.E. 1940. Supplementary material is also included.

The purpose of the theses was to investigate the influence in gilling of changes in draft and uncontrolled distance (U.D.) upon the physical properties of worsted yarns and fabrics processed from Noble combed top of good staple. The U.D. is the space existing between the front roll nip and the first row of faller pins. It is a variable, varying between the values X and Y. (Figs. 1 and 2) X = minimum U.D. Y = maximum U.D.

The theory involved (part of the theory of gilling) is outlined in three considerations:

1. Draft exerts a disturbing influence upon fiber control. An increase in draft will decrease fiber control and cause unevenness.

2. The uncontrolled distance limits the influence of pin control in that space. Better fiber control results when U.D. values, X and Y–X, are reduced.

3. The disturbing influence due to draft may be balanced by a reduction in the length of the U.D. and vice-versa.

Control of short fibers in the U.D. depends upon the controlling force of the longer undrafted fibers induced through the pinning. This force resists the disturbing pull of the fibers which are being drafted. Pin control extending into the U.D. will be affected adversely by either an increase in draft or an increase in U.D. An increase in U.D. may be balanced, therefore, by a decrease in draft, and the oppos1te is also suggested.

To test the theory, six yarns were processed from ½ blood, Noble combed top (5¼ in. maximum staple, 2⅝ in. average staple). Both single and two-ply yarns were prepared for testing. Routine Chart, Page 5, presents a comparison of the routines followed for yarn manufacture. The only differences are in gilling procedure: Draft and doublings were increased progressively for Yarns 1, 2, and 3, with a constant average U.D. of 0.77 in. The U.D. was increased progressively for Yarns, 1, 4, and 5, with draft and doublings kept constant. For Yarn 6, Mill Method, the U.D. was increased, and draft and doublings were reduced. Yarns 1, 2, 3, 4, and 5 were processed on the intersecting gill box. An ordinary gill box was used for Yarn 6.

The two-ply yarns were woven as filling in a warp made from 2/30s commercial worsted yarn. The filling was 2/32s. The fabric was a serge having a 2/2 twill weave.

In all operations for yarns and fabrics, care was taken to avoid any variations in process so that any significant differences revealed would be due only to the different yarn routines.

To measure the physical properties the single and plied yarns were tested for breaking strength, elongation, yarn number and turns per inch (T.P.I.). Single yarns were also tested for evenness of diameter. The fabrics were tested for filling breaking strength and elongation, using the grab method. Two hundred specimens constituted the sample for each yarn test, and 40 specimens for the fabric tests. The tests were made according to A.S.T.M. standards and after proper conditioning of yarns and fabrics in an atmosphere automatically controlled to maintain 65 ± 2% relative humidity.

To evaluate the results, the following statistical measures were selected as best suited to give the desired information; mean, standard deviation, coefficient of variation, and their respective errors. In making comparisons, differences in the coefficients of variation were obtained. The significance, or not, of these differences is important. The significance ratio of the difference between two measures is determined by dividing the difference by the standard error of that difference. Any significance ratio = 3 or greater is to be considered as significant.

Results of the investigations were based upon the magnitude of the significance ratios and on the coefficient of variation of breaking strength (which is taken as a measure of evenness.) Yarn 1 was used as a basis for comparison.

Supplementary material includes comparison factors (C.F.) for breaking strength of single and plied yarns, using data from the thesis; also the results of a commercial skein test of the single yarn, including comparison factors.

Due to differences existing in yarn number and turns per inch, a fair comparison of strength results could not be made. Comparison factors were therefore obtained using the following formula:

$$\frac{\text{Mean Breaking Strength} \times \text{Mean Yarn No.}}{\text{Mean Turns Per Inch}} = \text{C.F. for yarns}$$

The formula is reliable within small limits of variation of yarn number and turns per inch.

A summary which contains most of the important results of the tests together with their standard errors is presented on Page 4. Some of the data and results are presented graphically as follows:

Plot 3, Page 7. Comparison of the Means (of yarns)
Plot 4, Page 8. Comparison of the Coefficients of Variation (of yarns)
Plot 5, Page 6. Comparison of the Coefficients of Variation of Breaking Strength of Plied Yarns, and Grey and Finished Fabrics.

Conclusions reached as a result of these studies are:

Draft Series — Yarns 1, 2, and 3.

1. Progressive increases in draft and doublings, maintaining an average U.D. of 0.77 in. in gilling, produced no significant differences between breaking strengths, or between elongations of worsted yarns and fabrics.

2. When allowances are made for the probable influence of doublings,* there will be a significant increase in the irregularity of breaking strength when draft is increased without any increase in doublings.

Uncontrolled Distance Series — Yarns 1, 4, and 5.

3. When the uncontrolled distance is increased, doublings and draft remaining the same, the irregularity in both breaking strength and elongation does not change to any significant extent either in worsted yarns or fabrics. A definite trend towards increase in irregularity for elongation is revealed in the plied yarns.

4. An average U.D. of 1.625 in. produces a significant change in the evenness of single yarn diameter, whereas no appreciable change in irregularity is revealed with 1.25 in. average U.D.

Mill Method — Yarn 6.

5. The single yarn shows no appreciable change in irregularity of breaking strength and elongation. There is a noticeable increase in irregularity of the yarn diameter but the result is not significant.

6. In the plied yarn, for breaking strength and elongation, there is a trend towards increase in irregularity but the results are not significant.

7. If doublings had been equal to the standard (5 x 3), the influence of the increase would probably have produced a decrease in irregularity of breaking strength.

8. In the fabrics, Yarn 6 shows a significant increase in regularity of breaking strength over Yarn 1 in both grey and finished fabrics.

The comparison between coefficients of variation of strength of yarns and grey and finished fabrics indicates that the extent to which variations in the strength of the yarns is carried through and appears as variations in the strength of the fabric is questionable.

The results present evidence that, using a reasonable uncontrolled distance, an increase in draft in gill boxes necessitates an equal increase in doublings if the physical properties of the resultant yarns and fabrics are not to be affected adversely.

Better results will be obtained in gilling fine quality Noble combed tops when the

* R. L. Lee, Jr. "A Critical Study of Cotton Mfg. Processes", Textile Research, Vol. VII, No. 6, April, 1937, Page 241.

average uncontrolled distance does not exceed 1.25 in. This condition is possible, using a 1.5 in. diameter front roll, and 0.375 in. pitch screws, ordinary gill box.

In the presence of a large uncontrolled distance, a reduction in draft will compensate for lack of control over short fibers due to the large uncontrolled distance, an increased pitch of screw or both.

There is no indication that the intersecting gill box is superior to the ordinary gill box for gilling fine quality, good staple, Noble combed tops, with regard to the effect upon physical properties of the resultant yarns.

The results suggest further studies using fine ordinary gill boxes to process Noble combed top of inferior staple.

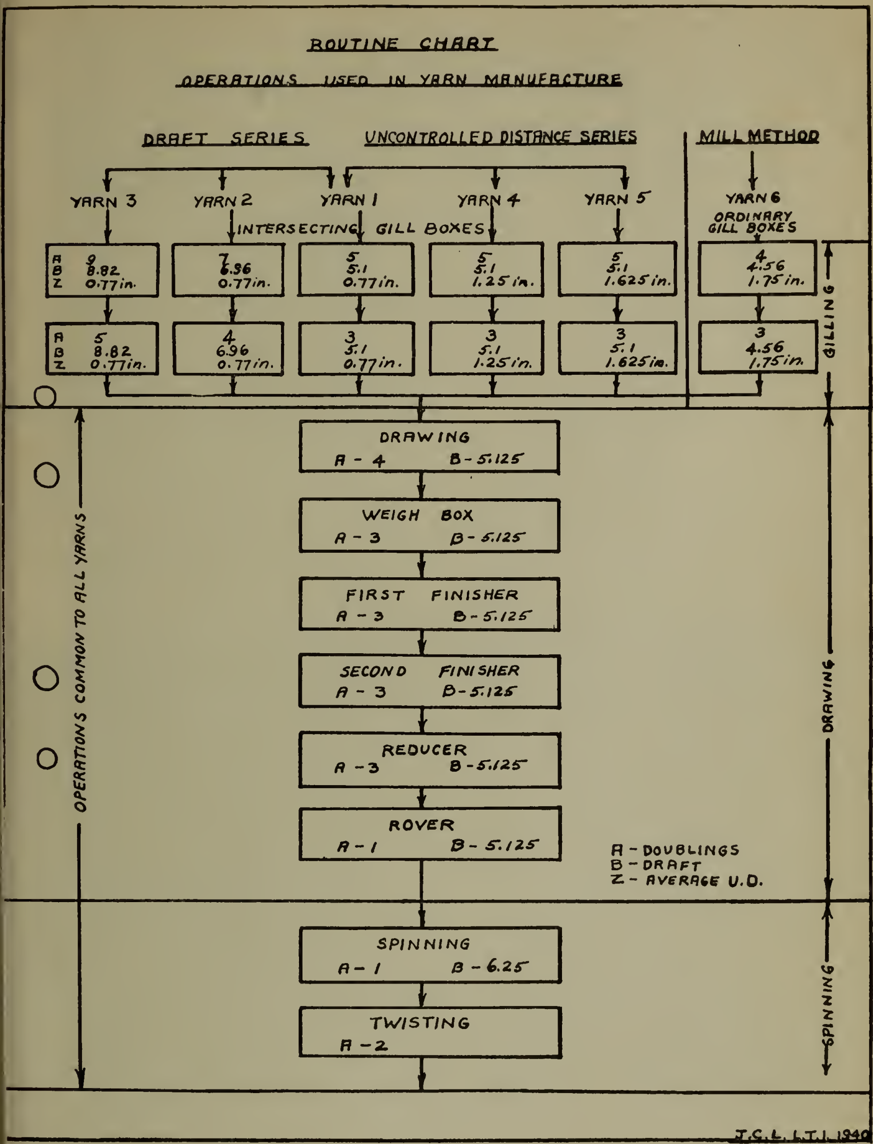
SUMMARY

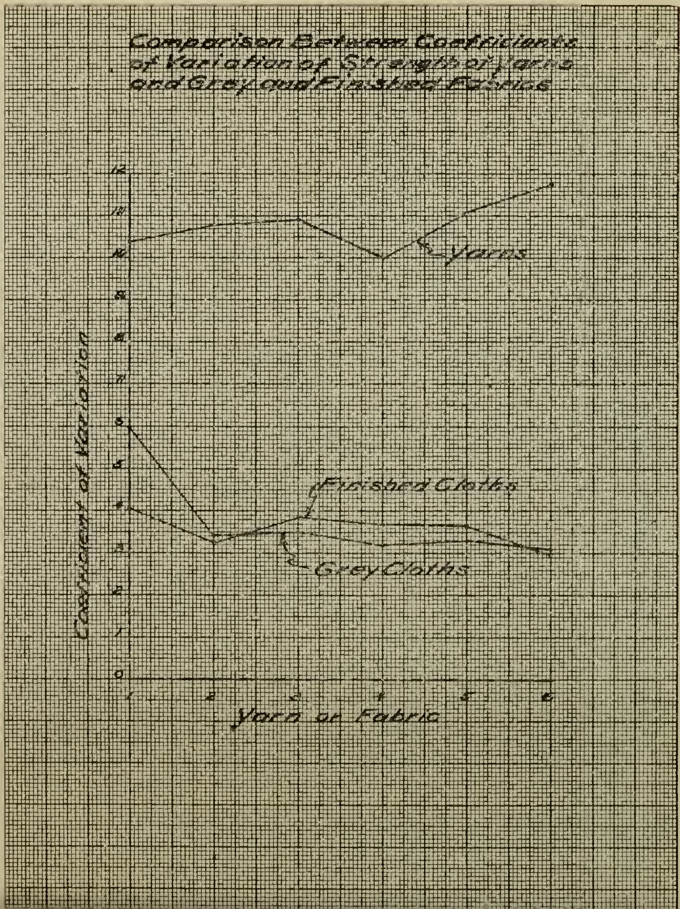
	Yarn 1	Yarn 2	Yarn 3	Yarn 4	Yarn 5	Yarn 6
			SINGLE YARNS			
Mean Yarn No.	1/32.6	1/32.2	1/31.7	1/32.2	1/32.1	1/32.3
Mean T.P.I.	13.70	13.60	13.37	13.43	13.31	13.32
Mean Breaking Strength — (grams)	117.5±1.6	118.5±1.6	122.0±1.6	120.2±1.6	128.7±1.8	117.7±1.6
Mean Elongation — (%)	10.6±0.2	11.5±0.2	12.7±0.2	11.9±0.2	13.0±0.3	11.4±0.2
Mean Diameter — (.001 in.)	7.4±0.1	7.5±0.1	7.7±0.1	7.8±0.1	8.0±0.1	7.5±0.1
			PLIED YARNS			
Mean Yarn No.	2/33.0	2/32.4	2/31.6	2/31.8	2/31.9	2/32.6
Mean T.P.I.	13.54	13.52	14.30	13.80	13.60	14.00
Mean Breaking Strength — (grams)	352.6±2.7	376.8±2.9	381.1±2.9	383.5±2.7	379.4±2.9	361.7±3.0
Mean Elongation — (%)	21.3±0.3	20.3±0.3	20.8±0.3	19.6±0.3	20.6±0.3	21.7±0.9
			SKEIN TESTS — SINGLE YARNS			
Mean Yarn No.	1/32.9	1/32.2	1/31.6	1/31.4	1/31.6	1/32.7
Mean T.P.I.	13.70	13.60	13.43	13.43	31.31	13.32
Mean Breaking Strength — (lbs.)	30.7	32.2	32.8	33.0	32.7	31.3
			COMPARISON FACTORS			
Single Yarns	280	282	289	288	310	285
Plied Yarns	429	449	425	442	445	421
Single Yarns — Skein Test	73.7	76.3	77.7	77.2	78.2	76.7
			COEFFICIENTS OF VARIATION			
Breaking Strength —						
Single Yarn	19.3±1.0	19.6±1.0	18.2±0.9	18.3±0.9	19.6±1.0	19.6±1.0
Plied Yarn	10.4±0.8	10.8±0.5	10.9±0.6	10.0±0.5	11.1±0.6	11.8±0.6
Skeins — Single Yarn	3.7±0.9	3.6±0.8	4.1±1.0	4.2±1.0	4.4±1.1	6.1±1.4
Grey Cloth	6.0±0.9	3.4±0.4	3.5±0.4	3.2±0.4	3.3±0.4	3.1±0.4
Finished Cloth	4.0±0.5	3.2±0.4	3.9±0.5	3.7±0.5	3.7±0.5	3.0±0.4

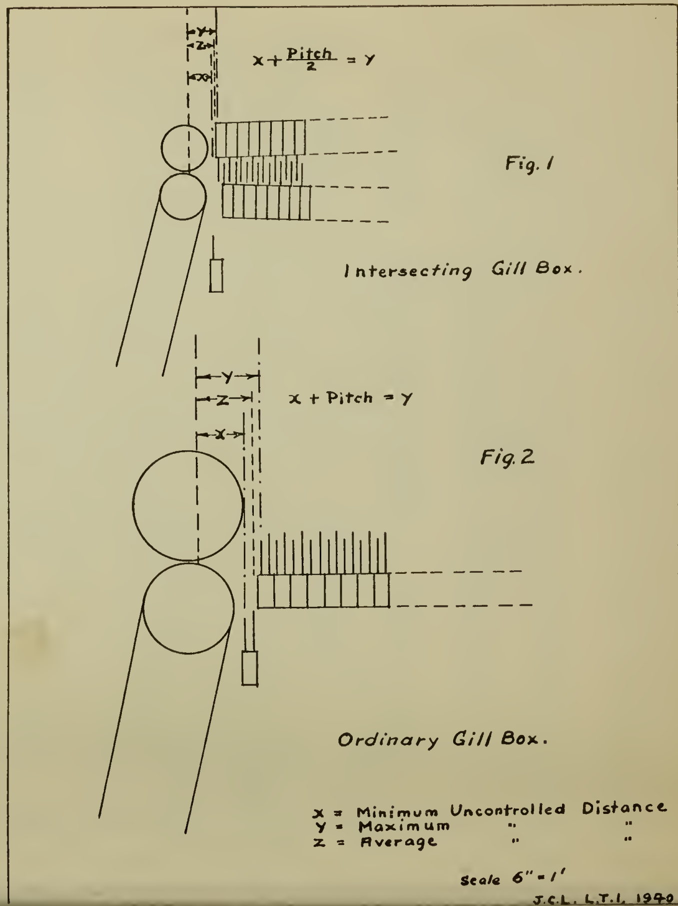
SIGNIFICANCE RATIOS*

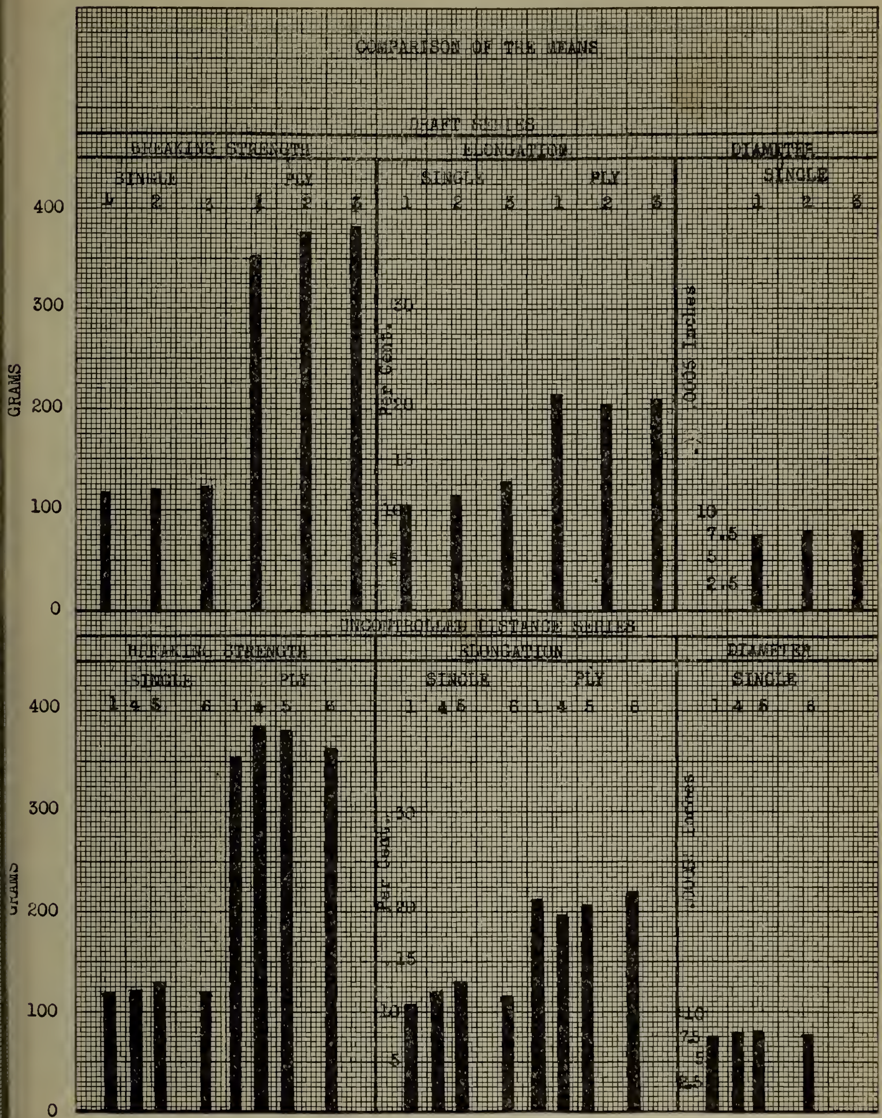
Yarns	Yarns 1 and 2	Yarns 1 and 3	Yarns 1 and 4	Yarns 1 and 5	Yarns 1 and 6
Breaking Strength — Single Yarn	+0.25	—0.77	—0.69	+0.25	+0.25
Plied Yarn	+0.58	+0.69	—0.50	+0.97	+1.78
Elongation — Single Yarn	—0.90	—1.15	—1.54	+2.31	None
Plied Yarn	+2.02	+1.42	+2.44	+1.56	+2.82
Diameter — Single Yarn	+0.71	—0.56	+0.74	+3.22	+2.41
Breaking Strength — Fabrics	1 and 2	1 and 3	1 and 4	1 and 5	1 and 6
Grey Cloth	—2.69	—2.52	—2.89	—2.76	—3.02
Finished Cloth	—1.21	—0.24	—0.49	—0.52	—1.65

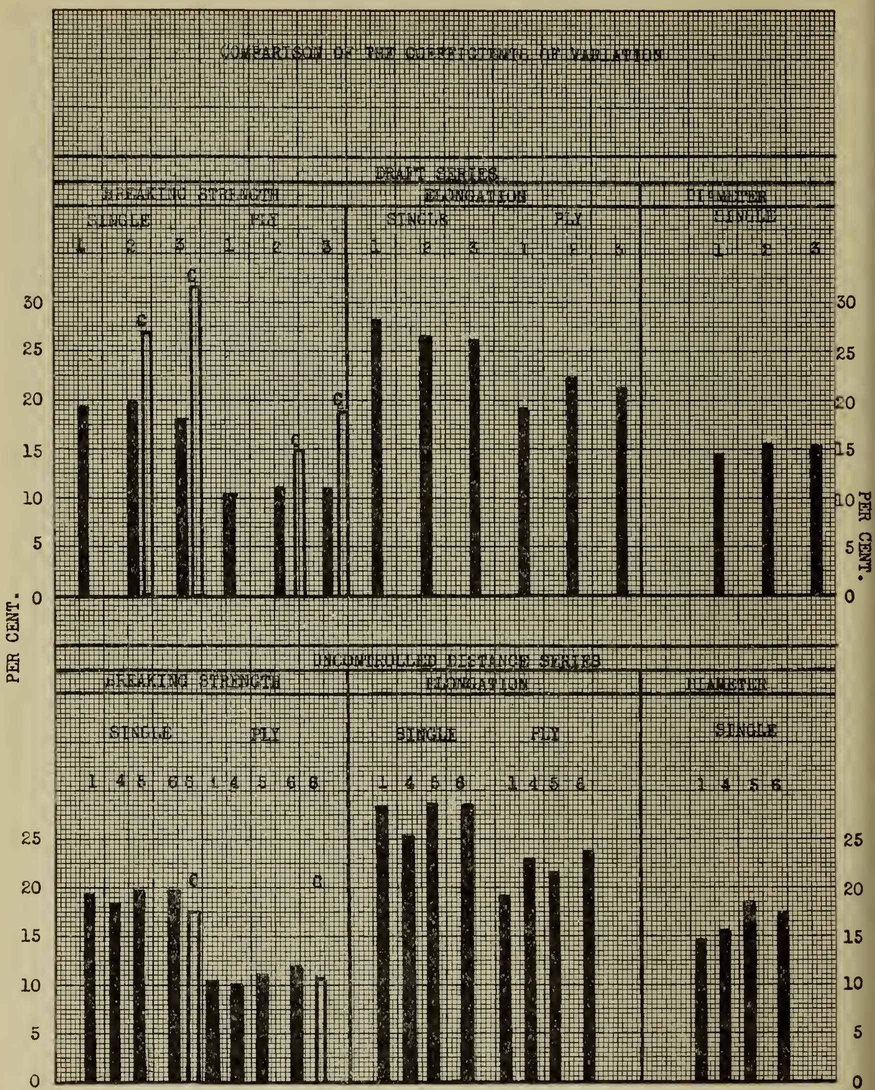
* + indicates decrease in regularity.
— indicates increase in regularity.


ROUTINE CHART
OPERATIONS USED IN YARN MANUFACTURE
DRAFT SERIES
UNCONTROLLED DISTANCE SERIES
MILL METHOD
YARN 3
YARN 2
YARN 1
YARN 4
YARN 5
YARN 6
ORDINARY GILL BOXES
INTERSECTING GILL BOXES
A 9 B 8.82 Z 0.77 in.
7 6.96 0.77 in.
5 5.1 0.77 in.
5 5.1 1.25 in.
5 5.1 1.625 in.
4 4.56 1.75 in.
A 5 B 8.82 Z 0.77 in.
4 6.96 0.77 in.
3 5.1 0.77 in.
3 5.1 1.25 in.
3 5.1 1.625 in.
3 4.56 1.75 in.
GILLING
DRAWING A - 4 B - 5.125
WEIGH BOX A - 3 B - 5.125
FIRST FINISHER A - 3 B - 5.125
SECOND FINISHER A - 3 B - 5.125
REDUCER A - 3 B - 5.125
ROVER A - 1 B - 5.125
A - DOUBLINGS
B - DRAFT
Z - AVERAGE U.D.
DRAWING
OPERATIONS COMMON TO ALL YARNS
SPINNING A - 1 B - 6.25
TWISTING A - 2
SPINNING
J.C.L. L.T.I. 1940


Comparison Between Coefficients of Variation of Strength of Yarns and Grey and Finished Fabrics
Coefficient of Variation
Yarn or Fabric
Yarns
Finished Cloths
Grey Cloths


x + Pitch/2 = y
Fig. 1
Intersecting Gill Box.
x + Pitch = y
Fig. 2
Ordinary Gill Box.
x = Minimum Uncontrolled Distance
y = Maximum " "
z = Average " "
Scale 6" = 1'
J.C.L. L.T.I. 1940


COMPARISON OF THE MEANS
DRAFT SERIES
BREAKING STRENGTH
ELONGATION
DIAMETER
SINGLE
PLY
GRAMS
Per Cent.
.0005 Inches
UNCONTROLLED DISTANCE SERIES
BREAKING STRENGTH
ELONGATION
DIAMETER
SINGLE
PLY
GRAMS
Per Cent.
.0005 Inches



C = Corrected for Influence of Doublings

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2500—12-40—4588.

THE DETERMINATION OF THE LENGTH SHRINKAGE CHARACTERISTICS OF FINE OHIO DELAINE WOOL

By
Lawrence W. Smith, B.S., M.S., Lieut. S.C., U.S.N.
and
Russell L. Brown, B.T.E., M.S.,
Assistant Professor of Textiles

The purpose of this paper is to present a report of a graduate thesis which was prepared under the direction of Professor Herbert J. Ball, in charge of the Textile Engineering Department.

The object of this thesis was to study the length shrinkage characteristics of fine Ohio Delaine wool when subjected to commercial washing or scouring operations.

The material used consisted of fine Ohio Delaine wool scoured, fine Ohio Delaine wool Frosted (unscoured), a commercial wool oil, a standard soap solution for scouring, and a warp of 4½ run woolen yarn, 64's wool, 12 T.P.I. 1200 ends, 2/14½ reed, 39½" wide.

Five lots of 4½ run yarn were spun for testing. In each lot a sufficient weight of Frosted wool was added so that when spun the yarn would contain the desired proportions of clean scoured fiber to clean Frosted fiber. In each successive lot the percentage of Frosted wool fiber content was increased by 10 percent. The essential picking and spinning data are given in Tables 1 and 2.

TABLE 1—PICKING DATA

Lot No.	*Wool* Frosted %	Frosted lbs.	Scoured %	Scoured lbs.	Total lbs.	*Emulsion* Oil lbs.	Water lbs.	Wool & Oil lbs.
1	0.0	0	100.0	20	20	6	12	26
2	10.0	2	90.0	9	11	2.7	5.4	13.7
3	20.0	8	80.0	16	24	4.8	9.6	28.8
4	30.0	6	70.0	7	13	2 1	4.2	15.1
5	40.0	16	60.0	12	28	3.6	7.2	31.6

TABLE 2—SPINNING DATA

Lot No.	Wt. 50 yd. roping	Spinning draft	Tube speed r. p. m.	T. P. I.	Wt. 50 yd. yarn grey	Wt. 50 yd. yarn scoured	Scour loss
1	90 grains	1.55	1620	16	58 grains	48 grains	16.6
2	90 grains	1.56	1620	16	59 grains	48 grains	18.7
3	95 grains	1.49	1620	16	60 grains	47 grains	20.1
4	102 grains	1.64	1620	16	63 grains	49 grains	22.8
5	87 grains	1.28	2280	16	64 grains	47 grains	25.4

The yarn was then tested after adequate exposure in the standard atmosphere of the testing laboratory. To determine the length shrinkage caused by washing, 10-yard skeins were reeled of each lot of the yarn on a 1-yard reel and their length measured carefully before and after scouring under a tension of 30 ounces. Cloth was also woven with these lots as filling across a standard warp. This cloth was cut into strips 20" long filling wise and raveled to contain 20 strands as in the 10-yard skeins of yarn. These strips were measured carefully for length before and after scouring under a tension of 30 ounces.

To determine the breaking strength of the yarns, 50-yard skeins were made which were weighed and tested for strength, before and after scouring, under standard A.S.T.M. procedure. Raveled strip specimens 6" x 1" were prepared from the cloth and tested for strength, before and after scouring, by a similar procedure. A summary of the test results is given in Table 3 and shown in graphical form in Plates I, II and III.

TABLE 3—SUMMARY OF RESULTS

Lot No.	Gross Scour Loss—%	*Strength—lbs.* 50-yd. Skeins Grey	50-yd. Skeins Scoured	Raveled strips Grey	Raveled strips Scoured	*Shrinkage—%* 10-yd. skeins	Raveled strips
1	14.8	59.7	54.7	23.7	22.8	1.81	.93
2	17.1	58.5	46.4	24.3	20.8	1.69	.72
3	20.7	52.7	44.9	19.9	18.5	1.40	.71
4	21.8	44.0	33.5	21.6	17.5	.83	.30
5	25.9	32.3	26.9	17.4	14.4	.70	.25

(*Continued on page 4*)

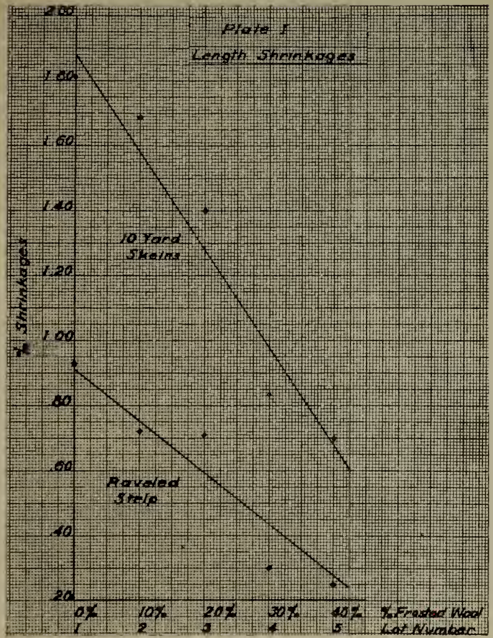
Plate I
Length Shrinkages
% Shrinkages
2.00
1.80
1.60
1.40
1.20
1.00
.80
.60
.40
.20
10 Yard Skeins
Raveled Strip
0% 10% 20% 30% 40% % Frosted Wool
1 2 3 4 5 Lot Number

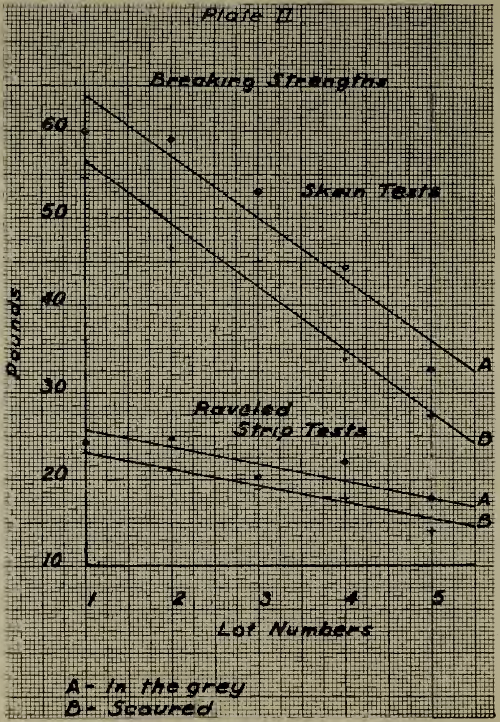
Plate II
Breaking Strengths
Skein Tests
Raveled Strip Tests
Pounds
60
50
40
30
20
10
A
B
A
B
1 2 3 4 5
Lot Numbers
A - In the grey
B - Scoured

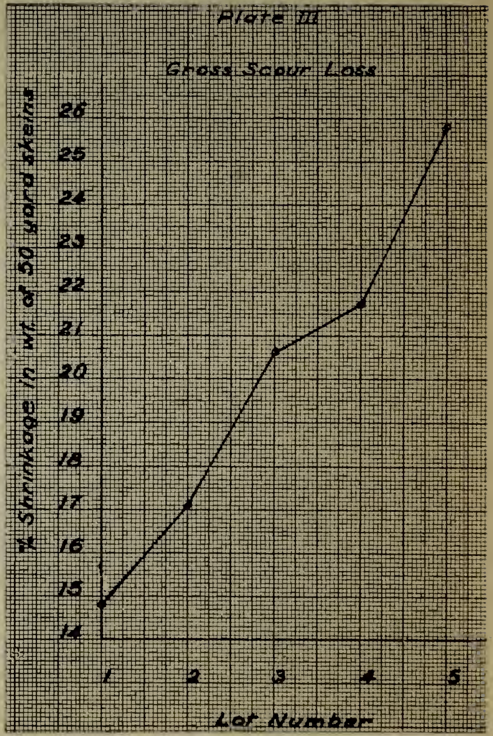
Plate III
Gross Scour Loss
% Shrinkage in wt. of 50 yard skeins
26
25
24
23
22
21
20
19
18
17
16
15
14
1 2 3 4 5
Lot Number

Variables other than the relative percentage of Frosted fiber to scoured fiber in the yarn were eliminated as completely as possible during manufacturing. It might be expected, therefore, that the percent shrinkage of the various lots in the yarn or the fabric form should increase as the percentage of Frosted fiber increases in the lot.

The major problem in proving the above hypothesis, aside from the manufacturing difficulties, lies in the selection of the most accurate means of testing to record such a trend. For this reason several preliminary investigations were completed. These showed that the shrinkage of the yarn from the grey to the scoured state was most accurately recorded by the skein and the strip tests.

In these tests as plotted it is noted that there was a decrease in the skein shrinkage of 0.3 percent per 10 percent increase in the amount of Frosted wool present.

The same trend holds true as shown by the raveled strip shrinkage test wherein there is a decrease in strip shrinkage of 0.16 percent per 10 percent increase of Frosted wool present.

As the percentage of Frosted wool per lot increased by 10 percent intervals the breaking strengths of the skeins decreased by 7.0 lbs. for the same intervals. As the percentage of grease wool per lot increased by 10 percent intervals, the breaking strength of the raveled strips decreased by 2.0 lbs. for the same intervals. The loss in the strength of the grey yarn and the grey raveled strips as the percentage of grease wool increases is probably due to the fact that Frosted fiber was shorter than the clean wool fiber.

The tests on breaking strengths of both the 50-yard skeins and the raveled strips indicate that the materials which have oil and grease present are stronger than those which have been scoured to remove this grease and oil.

It may be held that the presence of grease in yarn should allow the fibers to slip, giving less strength to the yarn than if clean. Since the reverse is indicated, some other explanation of the difference is necessary. It may be that the grease binds the fibers rather than lubricates. In other words, when greasy yarn is scoured the fibers become lofty and separate, losing part of their initial grip and contact with each other. thereby giving less wool density in the yarn and offering less resistance to strains.

The results of this thesis indicate that physical fiber shrinkage in commercial wool scouring is less than the shrinkage of the fiber when scoured in yarn form after spinning. The cause for such results may be found in the difference of fiber arrangement in loose form as compared to yarn form. It is possible that the presence of wax between the cells of the fiber structure prevent the closing up of these cells in the preliminary scouring. Subsequent scouring, however, causes these cells to come together and length shrinkage of fiber takes place. Additional scouring may well be the beginning of the phenomenon of felting as extensively studied by Messrs. Barker and Schofield of England.

The greater strength of these yarns in grey form over scoured form indicate that wool oils with certain properties in addition to facilitating carding and spinning operations may have a sizing effect beneficial in the weaving of the cloth.

Further studies of the shrinkage characteristics of other qualities of wool, such as one-half blood, three-eighth's blood and one-quarter blood, would be of value for comparison with the results of this thesis.

A study of wool lubricating oils of different characteristics would be of value in determining what properties produce the greatest yarn strength in the grey.

Southwick Hall Louis Pasteur Hall

SERIES 44, No. 3 *February, 1941*

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1941

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Act of October 3, 1917, authorized October 21, 1918

Moody Street and Colonial Avenue

PUBLICATION OF THIS DOCUMENT APPROVED BY THE COMMISSION ON ADMINISTRATION AND FINANCE
6500-3-41-5418.

CALENDAR

1940–1941

September 12–13, Thursday–Friday	Entrance Examinations
September 16–21, Monday–Saturday	Re-examinations
September 19, Thursday, 9.30 A.M.	Registration for Freshmen
September 23, Monday	Registration for upper-class students Classes begin for Freshmen
September 24, Tuesday	Classes begin for upper-class students
October 12, Saturday	Columbus Day — Holiday
November 11, Monday	Armistice Day — Holiday
November 28, Thursday	Thanksgiving Day — Holiday
December 20, Friday, 4.00 P.M.	Christmas recess begins
January 6, Monday, 8.30 A.M.	Christmas recess ends
January 20, Monday	First term examinations begin
January 31, Friday	End of first term
February 3, Monday	Second term begins
February 22, Saturday	Washington's Birthday — Holiday
April 4, Friday, 4.00 P.M.	Spring recess begins
April 14, Monday, 8.30 A.M.	Spring recess ends
April 19, Saturday	Patriots' Day — Holiday
May 26, Monday	Second term examinations begin
May 30, Friday	Memorial Day — Holiday
June 10, Tuesday	Commencement
June 12–13, Thursday–Friday	Entrance Examinations

1941–1942

September 15–16, Monday–Tuesday	Entrance Examinations
September 15–20, Monday–Saturday	Re-examinations
September 18, Thursday, 9.30 A.M.	Registration for Freshmen
September 22, Monday	Registration for upper-class students Classes begin for Freshmen
September 23, Tuesday	Classes begin for upper-class students
October 13, Monday	Holiday — Observance of Columbus Day
November 11, Tuesday	Armistice Day — Holiday
November 26, Wednesday, 4.00 P.M.	Thanksgiving recess begins
December 1, Monday, 8.30 A.M.	Thanksgiving recess ends
December 19, Friday, 4.00 P.M.	Christmas recess begins
January 5, Monday, 8.30 A.M.	Christmas recess ends
January 19, Monday	First term examinations begin
January 30, Friday	End of first term
February 2, Monday	Second term begins
February 23, Monday	Holiday — Observance of Washington's Birthday
March 27, Friday, 4.00 P.M.	Spring recess begins
April 6, Monday, 8.30 A.M.	Spring recess ends
April 20, Monday	Holiday — Observance of Patriots' Day
May 25, Monday	Second-term examinations begin
May 30, Saturday	Memorial Day — Holiday
June 9, Tuesday	Commencement
June 11–12, Thursday–Friday	Entrance Examinations

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HISTORICAL SKETCH
of the
LOWELL TEXTILE INSTITUTE

By virtue of legislative acts of 1928, the Lowell Textile School became known as the Lowell Textile Institute in order to define more clearly the standing of the institution. This was the natural result of the development of the original ideas and policies of the trustees who founded the Lowell Textile School. The articles of incorporation were authorized by Chapter 475, Acts of 1895, and provided for a corporation to be known as the Trustees of the Lowell Textile School of Lowell, Massachusetts. The movement for the establishment of the school dates from June 1, 1891, but it was not opened for instruction until February 1, 1897.

In accordance with the acts of incorporation the Board of Trustees consisted of twenty permanent and self-perpetuating members, three-fourths of whom must be "actively engaged in, or connected with, textile or kindred manufactures." In addition, his Honor the Lieutenant-Governor, the Commissioner of Education of the State, the mayor, the president of the municipal council, the superintendent of schools of Lowell, and a representative of the textile council were members *ex-officio*. Legislative acts of 1905 and 1906 authorized the graduates of the school to elect four trustees serving for periods of four years each.

By virtue of the anti-aid amendment to the State Constitution, and by Chapter 274, General Acts of 1918, the property of the school was transferred on July 1, 1918, to the Commonwealth of Massachusetts, and the control and management of the school was vested in a Board of Trustees appointed by the Governor, "with all the powers, rights and privileges and subject to all the duties" of the original Board.

In locating the Institute at Lowell, which has been called the "Mother Textile City of America," considerable advantage is secured by close association with every branch of the industry, which utilizes almost every commercial fiber in the products of the great Merrimack Valley textile district.

Although the school was formally opened by Governor Roger Wolcott on January 30, 1897, in rented quarters in the heart of the city, it was not until January, 1903, that the first buildings of the present plant were ready for occupancy. On February 12, 1903, Governor John L. Bates dedicated the present buildings.

PURPOSE AND SCOPE OF THE INSTITUTE

The object of the establishment of the Institute as set forth in the original act was "for the purpose of instruction in the theory and practical art of textile and kindred branches of industry."

The plan was occasioned by the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the coarser cotton fabrics in the southern States. It was believed that this crisis could be met only by a wider and more thorough application of the sciences and arts in the production of finer and more varied fabrics.

Following the general methods and systems found successful at the higher polytechnic institutes, it offers thorough instruction in the principles of the sciences and arts applicable to textile and kindred branches of industry. The courses treat not only of the theory but also the application of these principles in the processes, on the machines and throughout all departments of industry involved in the successful manufacture, application and distribution of textile material in any form.

Though from the first the management has kept in view the clearly defined objective which called for the establishment of the Institute, it has developed its curriculum, its methods of instruction, and equipment as the needs of the industry arose. This objective will be kept constantly in view, and as new demands are presented an effort will be made to extend courses, equipment and floor space. The mechanical equipment of the Institute includes the best makes of textile machinery, and these machines, while built as they would be for regular work, are, as far as possible, adapted to the experimental work which is of particular value in such an institution as this.

Because of the breadth, grade and character of instruction given, and because of the standing and personnel of the instructing staff, the Institute has been placed

by both Federal and State educational boards in the class of the higher technological schools of this country.

The United States Civil Service Commission recognizes graduates from the degree courses of this school as proper applicants for the examination to the various positions requiring a knowledge of applied science and engineering, as well as a knowledge of textile manufacturing, in the different departments of the government.

The courses for those students who can attend the day classes are organized to prepare them to enter some one of the various branches of the textile industry. It is required that all such students shall have an educational background equivalent to that of a complete college preparatory course as given by a recognized high school or academy. These textile courses are either of three or four years duration and are described in detail on the following pages of this catalogue.

The evening classes are held for about twenty weeks of the year, and are for those who are unable to attend the day courses. These are similar to the day courses, but are aimed especially to meet the needs of students working during the day in the mills and shops. For entrance to these classes an applicant should have the equivalent of a grammar school education. A detailed description of these courses and requirements is given in another Bulletin, which will be sent upon request.

BUILDINGS AND GROUNDS

The site is a commanding one, consisting of about 15 acres at a high elevation on the west bank of the Merrimack River. It extends to and overlooks the rapids of Pawtucket Falls, which was the first water power in America to be used on an extensive scale to operate power looms. It was contributed by Frederick Fanning Ayer, Esq., of New York City, and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Moody Street, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an arched way from which access is had to the wings and to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, and Library, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughters; the Kitson Machine Company of Lowell, founded by Mr. Kitson, was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department and by the Woolen and Worsted Yarn Department, and contains on the lower floors an equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three story addition was placed on a single story building that was previously known as the Colonial Avenue Building which was erected in 1910. This Hall contains on the first floor the Cotton Finishing laboratory with class rooms and offices of the Wool Department. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry and Textile Coloring Department.

CAMPUS

Through the generosity of Mr. Frederick Fanning Ayer the Institute has been provided with a campus and athletic field of about 3 acres. This has been carefully graded and laid out for football and track athletics.

To enclose this field the Alumni Class Fence has been partly built. It is made of forged iron sections supported between brick columns. Each section is contributed by a class, so that in the course of a few years this fence will entirely enclose the field.

In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will, it is hoped, be further improved to make a modern campus for baseball and other sports.

GENERAL INFORMATION

Application for Admission.—A blank form of application for admission may be found at the end of this bulletin. This should be properly filled out by all applicants, whether entering upon certificate from a secondary school or presenting themselves for examination.

Freshman Registration.—Each freshman is expected to be in daily attendance beginning Thursday, September 18, at 9.30 A.M., and to follow the prepared program which will be placed in his hands. A program which is planned to acquaint the new student with the institution, its location and surroundings, its courses of instruction, its recreational activities and other phases of its life is arranged for the opening week. Unless arrangements for room and board are made previously, the first two days of the week may be used for this purpose. Physical examinations as well as certain other tests are given during this orientation period. Freshman week enables the student to secure the advantages which come from acquaintance with his surroundings, his instructors, the members of his class, student organizations, activities and customs. The overcrowding of the first week of classes with distractions is thus avoided.

Registration.—All upper classmen are required to register on or before the Monday of the week beginning the school year, and all students during the midyear examination period. For unexcused delay in registration a fee of $5 will be imposed.

Sessions.—The regular school sessions are in general from 8.30 A.M. to 12.20 P.M., and from 1.25 to 4.00 P.M., except Saturdays, when no classes are held. On Saturday afternoons the buildings are closed.

An hour plan designates the hours at which the various classes meet. This is rigidly adhered to, and the student is marked for his attendance and work as therein scheduled.

Attendance.—Attendance is required of all students on fourteen-fifteenths of all scheduled class exercises, provided they meet the requirements of their instructors for the omitted exercises. For every unexcused absence from any class exercise in excess of those allowed, a deduction will be made from the mark obtained in the course in which the absences occurred.

Advisers.—Advisers are appointed for all students, to be of such aid and assistance as they can both inside and outside of school hours. The head of the department in which a student is registered is adviser to upper-classmen, and instructors in charge of freshmen classes act as advisers to freshmen.

Conduct.—Students are required to return to the proper place all instruments or apparatus used in experimental work, and to leave clean and in working order all machinery and apparatus with which they may experiment. All breakages, accidents or irregularities of any kind must be reported immediately to the head of the department or instructor in charge.

Irregular attendance, lack of punctuality, neglect of either school or home work, disorderly or ungentlemanly conduct or general insubordination are considered good and sufficient reasons for the immediate suspension of a student, and a report to the trustees for such action as they deem necessary to take.

It is the aim of the trustees so to administer the discipline of the Institute as to maintain a high standard of integrity and a scrupulous regard for trust. The

attempt of any student to present, as his own, work which he has not performed, or to pass an examination by improper means, is regarded by the trustees as a most serious offense, and renders the offender liable to immediate suspension or expulsion. The aiding or abetting of a student in any dishonesty is also held to be a grave breach of discipline.

Any student who violates these provisions will be immediately suspended by the president, and the case reported at the following meeting of the trustees for action.

Examinations.—For first-year students examinations are held every five weeks, and these serve to inform the student concerning his standing and the progress made. For students in upper classes examinations will be held during the eighth week of each term. Final examinations are held at the end of each term.

In general, the examinations cover the work of the preceding term, but at the discretion of the instructor may include work of earlier terms.

Examinations for students conditioned in first-term subjects are held during the second term, and examinations for students conditioned in the second-term subjects are held in September following. Students requesting condition examinations at other than scheduled dates will be required to pay $5 for each examination so taken.

Any student who fails to complete a subject satisfactorily or to clear a condition at the time appointed, will be required to repeat the subject, and he cannot be admitted to subjects dependent thereon.

A student whose term's standing is as a whole so low that he cannot continue with profit the work of the next term will be required to leave, but he may return the following year to repeat such subjects as are required.

Daily work and regularity of attendance are considered in making up the reports of standing.

Records and Reports of Standing.—During each term informal reports are sent to parents or guardians and to all students; and at the end of each term formal reports are made.

The daily work of the student forms an important part of his record, and no pupil will be awarded the diploma or degree unless this portion of his record is clear.

Books are prescribed for study, for entry of lecture notes and other exercises, and are periodically examined by the lecturers. The care and accuracy with which these books are kept are considered in determining standing.

Library and Reading Room.—That the students may have surroundings conducive to reading and study a moderate-sized reading room with library tables and chairs has been provided. The library shelves contain textile, art, engineering and scientific publications. These are increased from time to time as new technical books of value to textile students are issued from the press. The leading textile papers are kept on file for ready reference.

The Chemistry and Dyeing Department also has a library supplied with books and periodicals which pertain to chemistry in general and textile chemistry and dyeing in particular.

FEES, DEPOSITS, ETC.

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts. For non-residents the fee is $250 per year. The fee for students from foreign countries is $500 per year.

Three-fifths of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trustees. The above fee includes free admission for any day students desiring to attend any of the evening classes in which there is accommodation.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the president for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Athletic Fee.—An athletic fee of $15 is due and payable at the time of the first payment of tuition.

Deposits.—Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Student Aid.—The Student Work Program under the National Youth Administration for Massachusetts has been carried on during the years that these funds have been available. The average amount earned by each student assigned to a project is approximately ten dollars per month. Applications should be made to the General Office at the Institute.

Rooms and Board.—Students from a distance, requiring rooms and board in the city, may, if they desire, select same from a list which is kept at the Institute. The cost of rooms and board in a good district is $12 per week and upwards.

Books and Materials.—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Each student must provide himself with proper outer garments and wear them in such a manner when working in the various laboratories that clothing and person will be protected and not endangered by moving machinery or chemicals.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the department may retain such specimens of students' work as they may determine.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

Summary of Expenses per Year

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (foreigners)	500
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Athletic fee	15
Machine shop deposit	10
General breakage fee (This applies to students who do not take chemistry or machine shop.)	10
Books and supplies (Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	50

ENTRANCE REQUIREMENTS

Particular stress should be laid upon a thorough grounding in mathematics, including algebra, arithmetic and plane geometry, as these form the basis upon which the work of this school rests. While solid geometry is not required at the present time, the student will find a knowledge of this subject very valuable in his subsequent work, and is strongly recommended to include this subject as one of his electives. A preliminary course in science, including physics and chemistry, serves to prepare the student's mind for the higher branches of these subjects and their application, but neither will be considered as the equivalent of the courses in these branches given in the Institute.

Degree Courses

Candidates for admission to either of the degree courses must be graduates of a school approved by the New England College Entrance Certificate Bcard or by the board of Regents of New York, and must present a certificate from the principal of the school last attended, reporting upon the subjects pursued and the points obtained according to the schedule of studies given hereafter. A total of fifteen points is required.

A point represents satisfactory work in a year's study in a specified subject in an approved secondary school.

Required Subjects	
Algebra A1	1
Algebra A2	1
English	4
Language other than English	2
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry	1
	12

Elective Subjects	Points
Elementary French (two years) or Elementary German (two years)	2
Advanced French or German (one year in addition to requirements of Elementary French A or Elementary German A)	1
History:	
American	1
Medieval and Modern	1
English	1
Latin	1
Mechanical Drawing	1
Mechanic Arts	1
Solid Geometry	1
Spanish	1
Trigonometry	1

An applicant may also be admitted on the basis of entrance examinations, in which case he must pass a sufficient number of the required subjects to make eleven points and present certificates showing satisfactory courses in such of the elective subjects to make four additional points.

The objective of the elective requirements is to encourage greater breadth of preparation than that covered by the required branches. Certificates covering other subjects than those listed as elective will be entertained.

Diploma Courses

Candidates for admission to the diploma courses are accepted upon presentation of properly vouched certificates showing the completion of a regular four-year course in a high school or academy of reputable standing. The certificate must specify that the applicant has satisfactorily passed the required subjects.

A total of thirteen points is required.

Required Subjects	Points
Algebra A1	1
Algebra A2	1
English	4
Plane Geometry	1
History (American, Medieval and Modern, or English)	1
Physics	1
Chemistry	1
	10

Elective Subjects

Four may be selected from the list under Degree Courses.

ENTRANCE EXAMINATIONS

All students who are unable to present a certificate for either the degree or the diploma courses must pass entrance examinations. Notification of intention to take these examinations must be made in writing at least a week before the date of the examinations. These will be held as follows:—

Thursday, June 12, 1941; Monday, September 15, 1941; Thursday, June 11, 1942:—
- Algebra, 9 A.M. to 11 A.M.
- History, 11 A.M. to 1 P.M.
- English, 2 P.M. to 4 P.M.

Friday, June 13, 1941; Tuesday, September 16, 1941; Friday, June 12, 1942:—
- Plane Geometry, 9 A.M. to 11 A.M.
- German or French, 11 A.M. to 1 P.M.
- Chemistry, 11 A.M. to 1 P.M.
- Physics, 2 P.M. to 4 P.M.

Candidates failing to pass the June examinations are allowed to try again in September; those who cannot attend the June examinations may present themselves in September.

REQUIRED SUBJECTS FOR ENTRANCE

Algebra A1.—Derivation and use of simple formulas, graphical representation, the meaning and use of negative numbers, linear equations, with one or two unknown quantities, ratio and proportion, the essentials of algebraic technique, simple cases of exponents and radicals.

Algebra A2.—Numerical and literal quadratic equations in one unknown quantity, the binomial theorem for positive integral exponents, arithmetic and geometric series, simultaneous linear equations in three unknown quantities, simultaneous equations consisting of one quadratic and including graphical solutions, exponents and radicals.

Plane Geometry.—The usual theorems and constructions of good textbooks, including the general properties of plane rectilinear figures, the circle and the measurement of angles, similar polygons, areas, regular polygons, and the measurement of the circle. The solution of original problems and problems in mensuration of lines and plane surfaces.

Chemistry.—Requirements are those of the New England College Entrance Board, or the Board of Regents of New York, including personal laboratory work. Those not meeting the requirements by school or college certificate will be subject to written examination.

English.—As secondary schools are following to a greater extent than heretofore the requirements of the College Entrance Examination Board, it is recommended that the applicant to this school conform to the suggestions of this Board relative to English composition and literature.

The examination consists of two parts, both of which are given at the same time.

(*a*) With the object of testing the student's ability to express his thoughts in writing clearly and correctly he will be required to write upon subjects familiar to him. Emphasis will be laid upon the composition, punctuation, grammar, idiom and formation of paragraphs. He will be judged by how well he writes rather than by how much he writes.

(*b*) The second part of the examination is prepared with the view of ascertaining the extent of the student's knowledge of good literature, and to test this examination questions will be based on the books adopted by the National Conference on Uniform Entrance Requirements. Any course of equivalent amount if made up of standard works will be accepted.

History.—Applicants may offer a preparation of American history, English history, or medieval and modern history.

In American history applicants should be familiar with the early settlements in America, the colonies, their government, the customs of the people, and events which led to the establishment of the United States. They should be informed concerning the causes and effects of the principal wars in which the country has been involved. They should be prepared to consider also questions requiring an elementary knowledge of civil government, as well as historical facts connected with the growth of this country up to the present time.

For the subject of English history or medieval and modern history the course given in any reputable secondary school should give proper preparation. A course extending over a full year with not less than three periods a week will be accepted.

Physics.—The applicant should be familiar with the fundamental principles of physics, particularly those considered under the headings of mechanics, heat, light, electricity and magnetism. Textbook instruction should be supplemented by lecture table experiments. Wherever possible, the student should pursue a laboratory course, but for the present no applicant will be conditioned in this subject if he has not been able to carry on a laboratory course. Where a laboratory course is offered by a secondary school, it should cover at least twenty-five of those experiments listed in the syllabus of the College Entrance Examination Board.

Modern Languages.—Required for degree courses only. It is expected that the work in these subjects has covered a period of at least two years of preparatory school training or the equivalent. Importance should be given to the ability to translate into good idiomatic English, but attention should also be paid to grammar and construction, that greater care may be used in translation.

Elementary German A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple German prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into German.

The requirements include the declension of articles, adjectives, pronouns and nouns; the conjugation and inflection of weak and strong verbs; the simpler uses of the subjunctive; the use of the modal auxiliaries; the prepositions and their uses; the principal parts of important verbs; and the elementary rules of syntax and word order.

Texts used in the language courses of any reputable high or preparatory school will furnish reading for translation. A list of texts is offered by the College Entrance Examination Board.

Elementary French A.—The entrance examination is composed of two parts, both taken, however, at the same time.

(*a*) Translation of simple French prose into good idiomatic English.

(*b*) Questions to test proficiency in grammar, and simple English sentences to be rendered into French.

The requirements include the principal parts, conjugation and inflection of the regular and the more common irregular verbs; the singular and plural forms of nouns and adjectives; the uses of articles and partitive construction; the forms and positions of personal pronouns; and the simpler uses of the conditional and subjunctive.

Suitable texts are suggested by the language courses of any reputable high or preparatory school and by the requirements of the College Entrance Examination Board.

Students who have pursued two years of elementary French as well as two years of elementary German may present one subject to cover two points in the required subjects, and the other to cover two points in the elective subjects.

ELECTIVE SUBJECTS

History.—If the applicant can present all three or any two branches of history specified he may include one as a required subject and the others in the list of elective subjects.

Solid Geometry.—The usual theorems and constructions of good textbooks, including the relations of planes and lines in space, the properties and measurement of prisms, pyramids, cylinders and cones; the sphere and spherical triangles. The solution of original problems and the applications of the mensuration of surfaces and solids.

Trigonometry.—The usual courses of instruction covered by the standard textbooks on plane and spherical trigonometry will prepare an applicant sufficiently to meet this requirement.

Mechanical Drawing.—The applicant must have pursued such a course in mechanical drawing that he will be familiar with the usual geometrical construction problems, projection of points, lines, planes and simple solids.

Importance is laid not only upon the accuracy with which the work is performed, but upon the general arrangement, appearance and care with which the plates are executed.

It should not be understood that work in this subject may be offered as the equivalent of the first term's work at the Institute.

Mechanics Arts.—The usual courses offered by properly equipped preparatory schools will be accepted as suitable fulfilment of this requirement. Work should include instruction in the handling of both wood and metal working tools in the more simple practices of these arts.

Elementary French B.—Applicants who enter for one of the three-year courses may present one year's work in French in a secondary school. Those who present themselves for examination in this subject should be familiar with the rudiments of grammar, and be able to translate simple French prose into good idiomatic English, also to translate into French English sentences, based on the French given for translation.

Elementary German B.—Applicants who enter for one of the three-year courses may present one year's work in German in a secondary school. What is stated in regard to French applies to those who may present German instead of French.

Advanced French or German.—In cases where applicants have pursued courses in French or German for more than two years, and have completed work which is more advanced than is included under elementary French or German, they may offer the additional year as an elective.

Spanish.—Students offering Spanish should be familiar with elementary grammar, the common irregular verbs, and be able to translate simple Spanish to English or English to Spanish. A preparation equivalent to three periods per week for two years will be acceptable.

Latin.—Students who have pursued one or more years of Latin may present this subject as an elective. Each year's work satisfactorily completed will be considered equal to one point.

ADVANCED STANDING

Candidates who may have received previous training in any of the subjects scheduled in the regular course will, upon presentation of acceptable certificates, be given credit for such work.

COURSES OF INSTRUCTION

Degree Courses.—The four-year degree courses are as follows:

Textile Engineering.
Chemistry and Textile Coloring.

At the completion of these courses the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) are conferred.

Five options are offered in the Engineering Course, viz., general textile, cotton manufacturing, wool manufacturing, design, or sales option. Each of these courses is planned to train one in the fundamental principles of science found to be applicable in the particular fields of textile chemistry and textile engineering. It is maintained that for one to be successful in either of these important branches of industry a training is required as thorough and broad as that of any of the recognized branches of engineering or of applied science.

With this in mind these courses have been built of a secure framework of science and mathematics, and to it has been added the useful application of these branches in the broad textile field. With the direct purpose of laying a secure foundation in the training, a more extended preparatory course is first demanded, and subsequently in the school work more subjects of a general character are included, that narrowness of judgment and observation may not result by overstimulation of the technical development.

Diploma Courses.—The following courses extend over a period of three years and upon the completion of any one of these the diploma of the Institute is awarded:

Cotton Manufacture.
Wool Manufacture.
Textile Design.

These are the original courses offered at the Institute, arranged to require three years' study and to give the student as thorough a training as possible for his chosen field, stressing particularly the study of textiles.

COURSES FOR WOMEN

Within the last few years the possibilities for women in certain branches of the textile field have become recognized and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some who choose the Textile Engineering Course with the design option, for it offers a broad training that prepares for many lines of activity. For those who wish to specialize in art and textile designing in their general application, courses will be arranged as far as the facilities of the Institute will permit. Some are interested in textile chemistry and pursue the Chemistry and Textile Coloring Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

GRADUATE COURSES

By act of the General Court of 1935, authority was given to the Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry and Master of Science in Textile Engineering to graduate students who satisfactorily complete courses of advanced standing.

The object of the courses is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their respective department and to take work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees of other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance to that industry.

Graduates of this Institute will be required to devote at least one year residential study and graduates in general of other institutions at least two years residential study in order to receive the Master degree. Admission to advanced standing may be permitted where the applicant can present work which is approved by the department head as equivalent.

The tuition fees and deposits for graduate students are the same as those required for undergraduates. In general a graduate of this Institute shall devote approximately one third of his course to subjects of advanced character in his own department. One third of his course may be in subjects of his own or other departments not taken in undergraduate work and the remaining third of his course shall be occupied in a thesis of an advanced character and approved by the head of the department.

The courses of study for graduates of other colleges and technological institutions cannot be prescribed in detail for the reason that the selection must depend upon previous scholastic work and standing. They must include the essential subjects of textile education required in the particular department which the applicant elects and must receive the approval of the department head as well as the President and Faculty.

Students with proper preparation may be admitted to advanced courses but cannot be candidates for degrees unless they fulfill the above described requirements. All courses both undergraduate and graduate are open to women.

PHYSICAL EDUCATION AND ATHLETICS

Through competition in athletics and through instruction in classes in physical education the Department of Physical Education attempts to balance the intellectual and mental progress of the students by developing proper health habits, by promoting better physical development, and by inspiring high ideals of sportsmanship.

Physical education and athletics are under the supervision of the Head of the Physical Education Department, who is also Faculty Director of Athletics.

Physical Education

All members of the freshman class are required to take a course in physical training conducted in the gymnasium under the direction of an instructor in physical education. Two periods per week for the entire first year are devoted to this work. At the beginning of the year a full record is made of the physical examinations carried on by the instructor and a reputable physician that proper and beneficial exercise may be prescribed.

The object is to give general instruction in the care and strengthening of the body, and to so guide the students that they may continue to give proper thought to their physical training that their mental development may have its greatest effect.

Proper gymnasium clothing is required and all students must take a shower bath following each exercise.

Athletic Association

All students, by virtue of payment of the student athletic tax, are members of the Athletic Association and are represented by an executive council of sixteen, consisting of the president and athletic representative from each of the four classes, the captains and managers of the three varsity sports, and one representative each from the Pickout and the Textile Players. This Council acts as an advisory body to the Athletic Director, has charge of social and athletic events run by the Athletic Association, and ratifies the awarding of letters and appointment of student managers in the various sports.

The schedules of all sports are arranged with the interest of both the Institute and the individual members of the teams in mind. Admission to all home contests is included in the athletic fee which is paid by each student at the time of registration.

Teams are regularly maintained in varsity football, basketball, and baseball. Recently Textile has been represented by tennis and golf teams and by a junior varsity basketball team. Intramural competition is provided by interclass and interfraternity competition.

SUBJECTS OF INSTRUCTION

In the column headed "Hours of Exercise" the numbers represent for each particular subject the total hours required in school for a period of fifteen weeks.

The letter and number which follow the subjects indicate the department in which the subject is given and the number of the subject in that department. For detailed description of the same, see page 34.

The departments are indicated as follows:—

Textile Engineering	B	Cotton Yarns	F
Chemistry and Textile Coloring	C	Woolen and Worsted Yarns	G
Textile Design and Power Weaving	D	Finishing	H
Languages and History	E		

By referring to the letter and number indicated under "Preparation" the student can ascertain what subjects are necessary in order that he may have a clear understanding of the subject which he is scheduled to take.

First Year

First Term
(Common to all Courses)

	Hours of Exercise
Elementary Inorganic Chemistry C–10	105
English E–10	45
Mathematics B–10	60
Mechanical Drawing B–13	135
Physics B–11	75
Physical Education	30
Textile Design and Cloth Analysis D–10	75

Second Term

	Course IV	Course VI
Elementary Inorganic Chemistry C–10	30	30
Elementary Organic Chemistry C–11	45	45
Elementary German E–11	30	–
English E–10	45	45
Machine Drawing B–13 or B–13a	45	135
Mathematics B–10	60	60
Mechanism B–12	60	60
Physical Education	30	30
Qualitative Analysis C–12 or C–12a	150	45
Stoichiometry C–13	30	–
Textile Design and Cloth Analysis D–10	–	75

For second-term subjects in Courses I, II, and III, see pages 21, 23, 25.

Course I.—Cotton Manufacture

The Cotton Manufacturing Course is designed for students contemplating a career in the manufacturing of cotton yarns, cloth or allied industries, and wishing to devote but three years to instruction at the Institute.

During the first term the studies are common to all courses, and include instruction in mathematics, mechanical drawing, physics, textile design and elementary chemistry.

During the second term, lectures in organic chemistry are given followed by lectures in textile chemistry and dyeing the second year. The work in mechanism serves as a basis for all future machine and mechanical work, and is followed by steam engineering, electricity and mill engineering. The course in textile designing, cloth analysis and cloth construction includes lectures on plain, fancy and Jacquard weaves, the analysis of all commercial fabrics, and designs for the same.

Power weaving is taken up during the second and third years. Commencing with lectures and practice upon plain looms, the instruction continues with dobby, box-loom, and Jacquard weaving.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines. Instruction in the finishing of cotton fabrics is given by lectures and laboratory work, and requires considerable work on standard machines in the laboratory. Textile testing, also given in the third year, instructs the student in standard methods for physical testing of textile material.

The course in cotton carding is given in the second year. The instruction covers the production of cotton throughout the world, the classing of various cottons and the various methods of marketing the cotton crop. Particular emphasis is given to the American cotton crop. The treatment of cotton in the mill processes covers all the operations preparatory to spinning, for the regular cotton system and for the cotton waste systems. Opening, picking, carding, combing, drawing and roving are the operations included. Lectures supplement the material available in text books in order to have the course up to date. Considerable time is spent in the laboratory studying cotton fibers, classing, processing stock and making various tests on the adjustment of machines and the effect on the quality of the work produced.

The third year's work continues that of the second year, with detailed study of spinning, spooling, twisting and winding. Another course gives instruction in mill organization, balancing and arranging machinery in the mill. Finally, a brief course is given in the use of the microscope and camera in studying various problems in cotton manufacture. Laboratory practice supplements the lecture course, giving practical operation, adjustment and observation of the machines studied. Advanced laboratory work illustrates the methods of study and analysis of the more general and complex problems such as are usually handled in the laboratory of a textile plant.

During both the second and third years, particular attention is given to the preparation of the various reports in order that the student may learn proper methods for presenting data and conclusions resulting from mill studies and tests.

During the third year, each student makes some original study, usually of a technical nature. He must make a formal report of this study satisfactory to the faculty before receiving his diploma.

For detailed description of the subjects see page 32.

Course I.—Cotton Manufacture

[For first term see page 17]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	30	Mechanism B–12	60
Elementary Organic Chemistry C–11	45	Physical Education	30
English E–10	45	Qualitative Analysis C–12a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		

Second Year. First Term

Cotton Yarn Manufacture F–20	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–20	90
Power Weaving D–24	90		
Steam Engineering B–24	30		

Second Year. Second Term

Cotton Yarn Manufacture F–20	225	Textile Chemistry and Dyeing Lect. C-20	30
Color D–33	15	Textile Design and Cloth Construction D–20	75
Physics B–23a	45		
Power Weaving D–24	135		

Third Year. First Term

Cotton Finishing H–31	75	Mill Engineering B–34a	30
Cotton Organization F–32	60	Power Weaving D–32	165
Cotton Yarn Manufacture F–30	135	Textile Testing G–31	30
Electricity B–31a	30	Thesis F–34.	

Third Year. Second Term

Cotton Finishing H–31	75	Power Weaving D–32	120
Cotton Yarn Manufacture F–30	225	Thesis F–34.	
Knitting F–31	105		

Course II.—Wool Manufacture

The course on wool manufacturing is arranged for those who contemplate a career in the manufacture of woolen or worsted fabrics, and can devote but three years to the school work. It includes instruction on all of the varied processes employed in manipulating the wool fiber to produce yarn and cloth, namely, sorting, scouring, carding, combing, spinning, designing, weaving, dyeing and finishing. The work is carried on by lectures, recitations and practical work in the laboratories.

Beginning with the second year the details of manipulating wool from the grease to the finished yarn is taken up for close study. This includes the spinning of woolen yarn, also worsted yarn, by both the English and the French systems. The intermediate processes of sorting, scouring, carding, combing and top-manufacturing are taken in detail and in proper sequence. Instruction in the production and manipulation of re-worked wool is also included.

The general chemistry of the first year is followed by a lecture course in the second year on textile chemistry and dyeing.

Textile design, cloth analysis and construction are continued from the first year throughout the course, the work being applied especially to woolen and worsted goods. Weaving on power looms commences in the second year and continues through the third.

A course in knitting taken during the third year includes the manufacture of flat goods, hosiery and underwear. Considerable laboratory practice accompanies the lecture work, giving the students actual working knowledge of a wide range of knitting machines.

Lectures on finishing commence with the third year and are augmented by extensive practice with the machines in the Finishing Department.

Work in the Engineering Department extends throughout all three years, and includes mechanical drawing, steam engineering and electricity. The practical application of the principles studied in these subjects is brought out forcibly in the work on mill engineering, where mill design and construction are considered. A short course covering methods employed in the testing of fibers, yarns, and cloths, together with laboratory work in the manipulation of certain physical apparatus, is given in the third year.

For detailed description of the subjects see page 32.

Course II.—Wool Manufacture

[For first term see page 17]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	30	Mechanism B–12	60
Elementary Organic Chemistry C–11	45	Physical Education	30
English E–10	45	Qualitative Analysis C–12a	45
Machine Drawing B–13	135	Textile Design and Cloth Analysis D–10	75
Mathematics B–10	60		

Second Year. First Term

Fiber Preparation G–20–21	240	Textile Chemistry and Dyeing Lect. C–20	30
Physics B–23a	45	Textile Design and Cloth Construction D–21	75
Power Weaving D–24	105		
Steam Engineering B–24	30		

Second Year. Second Term

Color D–33	15	Textile Chemistry and Dyeing Lect. C-20.	30
Fiber Preparation G–20–21	270	Textile Design and Cloth Construction D–21	60
Physics B–23a	45		
Power Weaving D–24	105		

Third Year. First Term

Electricity B–31a	30	Textile Testing G–31	30
Knitting F–31	105	Woolen and Worsted Finishing H–30	75
Mill Engineering B–34a	30	Worsted Yarn Manufacture G–30	210
Power Weaving D–32	45		

Third Year. Second Term

Power Weaving D–32	195	Worsted Yarn Manufacture G–30	255
Woolen and Worsted Finishing H–30	75	Thesis.	

Course III.—Textile Design

The general course in textile design is planned to meet the demand of young men for a technical training in the general processes of textile manufacturing, but with particular reference to the design and construction of fabrics. To this end a foundation is laid in the first year by instruction in the elementary principles of designing, decorative art and weaving. That he may later in the course pursue to advantage instruction in yarn manufacturing, weaving, dyeing, finishing and some engineering problems, a foundation course in mechanics, mathematics and chemistry is laid. As the student is required to pursue courses in the yarn departments, both cotton and wool, he acquires a knowledge of the manufacture of cotton yarns from the bale to the yarn, and of woolen and worsted yarns from the fleece through the varied processes of manufacturing woolen yarn or worsted yarn by both the French and Bradford systems.

Throughout his entire course he receives instruction in design, cloth analysis and construction of all the standard cloths, viz., trouserings, coatings, suitings, blankets, velvets, corduroys, plushes, etc. This is followed by advanced work in Jacquard designing and weaving, which serves not only to acquaint the student with the many kinds of cotton, woolen, worsted and silk fabrics of figured design, but stimulates and develops any artistic talent he may possess. Decorative art becomes an important part of the work of the second and third years.

The courses of freehand drawing, perspective and color serve as means in applying the instruction received in courses of historic ornament, dynamic symmetry and textile styling to a better understanding of fashion trends and the changing designs that follow these. The actual pattern drafting and making of garments may be extended to a limited extent as time and individual skill permits.

The course in general inorganic and organic chemistry of the first year leads to the subject of textile chemistry and dyeing in the second year.

Power weaving commences with the second year and continues throughout the course, and work on all types of looms is required.

During the third year the student receives instruction in the finishing of cotton goods and woolen and worsted cloths. This instruction is given by means of lecture and laboratory work.

The engineering subjects given in the second and third years are intended to acquaint the student with such general knowledge as will be of assistance should he be called upon in later life to be a mill manager, or should his subsequent progress lead to some executive position in the operation of a textile plant.

For detailed description of the subjects see page 32.

Course III.—Textile Design

[For first term see page 17]

First Year. Second Term. (Hours of Exercise)

Elementary Inorganic Chemistry C–10	30
Elementary Organic Chemistry C–11	45
English E–10	45
Machine Drawing B–13	135
Mathematics B–10	60
Mechanism B–12	60
Physical Education	30
Qualitative Analysis C–12a	45
Textile Design and Cloth Analysis D–10	75

Second Year. First Term

Cotton Yarn Manufacture F–20a	90
Color and Dynamic Symmetry D–33, 34	30
Physics B–23a	45
Power Weaving D–24	90
Steam Engineering B–24	30
Textile Chemistry and Dyeing Lect. C–20	30
Textile Design and Cloth Construction D–20, 21	210

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60
Color and Dynamic Symmetry D–33, D-34	45
Fiber Preparation G–20–21	90
Jacquard Design D–23	45
Physics B–23a	45
Power Weaving D–24	75
Textile Chemistry and Dyeing Lect. C-20	30
Textile Design and Cloth Construction D–20, 21	135

Third Year. First Term

Cotton Finishing H–31	75
Cotton Yarn Manufacture F-30a	60
Decorative Art D–42	45
Power Weaving D–32	60
Textile Design and Cloth Construction D–30	90
Textile Testing G–31	30
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	90

Third Year. Second Term

Cotton Finishing H–31	75
Cotton Yarn Manufacture F-30a	60
Jacquard Design D–23	75
Power Weaving D–32	105
Textile Design and Cloth Construction D–30	75
Woolen and Worsted Finishing H–30	75
Worsted Yarn Manufacture G–30	60
Thesis.	

Course IV.—Chemistry and Textile Coloring

The four-year course in Chemistry and Textile Coloring, leading to the degree of B.T.C., is especially intended for those who wish to engage in any branch of textile chemistry, textile coloring, bleaching, finishing or the manufacture and sale of the dyestuffs or chemicals used in the textile industry. The theory and practice of all branches of dyeing, printing, bleaching, scouring and finishing are taught by lecture work supplemented by a large amount of experimental laboratory work and actual practice in the dyehouse and finishing room.

The underlying theories and principles of chemistry are the same, no matter to what industry the application is eventually made. Furthermore, no industry involves more advanced and varied applications of the science of chemistry than those of the manufacture and application of the coal-tar coloring matters. In addition, the textile colorist must consider the complex composition of the textile fibers, and the obscure reactions which take place between them and the other materials of the textile industry.

During the first year general chemistry, including both inorganic and organic, is taught by lectures and laboratory work, and this is supplemented during the second term by qualitative analysis and stoichiometry.

Advanced inorganic chemistry, as well as advanced organic chemistry, is studied during the second and third year as a continuation of the elementary chemistry of the first year, and much time is spent upon quantitative analysis, industrial chemistry, and textile chemistry and dyeing.

The foundation work in general chemistry is continued during the third year with courses in physical chemistry, organic laboratory work and analytical work. The subject of industrial chemistry is introduced, and much time is devoted to advanced textile chemistry, dye testing, color matching, calico printing, and woolen, worsted and cotton finishing.

The fourth year is characterized by an endeavor to present certain subjects of a more applied nature in such a manner that the student's reasoning power and ability to apply the knowledge gained during the first three years may be developed to the fullest extent. The subject of engineering chemistry is introduced, and the work in the dyeing and analytical laboratories is applied as far as possible to the actual requirements of the factory chemist and colorist. Much time is also spent in the organic chemistry laboratory, particular attention being given to the preparation of typical dyestuffs. Thorough courses are given in microscopy, photomicrography and the use of various instruments such as the spectroscope, ultra-microscope, polariscope, tintometer and other optical instruments applicable to experimental work in connection with the textile industry. Courses are also given in report writing and textile literature.

During this fourth year the student has an opportunity to take several elective subjects of an advanced nature and conduct such research work and original investigation as time may permit.

For detailed description of the subjects see page 32.

Course IV.—Chemistry and Textile Coloring

[For first year see page 17]

Second Year. First Term. (Hours of Exercise)

Advanced German E–21	45	Quantitative Analysis C–23	130
Organic Chemistry II C–22	30	Stoichiometry C–24	15
English E–20	30	Textile Chemistry and Dyeing Lab. C–21	90
Mathematics B–20a	60	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Power Weaving D–24a	15		

Second Year. Second Term

Advanced German E–21	45	Stoichiometry C–24	15
Organic Chemistry II C–22	30	Textile Chemistry and Dyeing Lab. C–21	145
English E–20	30	Textile Chemistry and Dyeing Lect. C–20	45
Physics B–23	65		
Quantitative Analysis C–23	150		

Third Year. First Term

Organic Chemistry III C–34	15	Physical Chemistry C–33	45
Adv. Textile Chemistry and Dyeing Lab. C–32	135	Quantitative Analysis C–30	150
Adv. Textile Chemistry and Dyeing Lect. C–32	30	Technical German C–35	30
Economics E–30	45	Woolen and Worsted Finishing H–30	75

Third Year. Second Term

Adv. Textile Chemistry and Dyeing Lab. C–32	90	Organic Laboratory I C–36	90
Adv. Textile Chemistry and Dyeing Lect. C–32	15	Physical Chemistry C–33	45
Economics E–30	45	Quantitative Analysis C–30	105
Industrial Chemistry C–31	30	Technical German C–35	30
		Woolen and Worsted Finishing H–30	75

Fourth Year. First Term

Adv. Textile Chemistry and Dyeing Lab. C–44	75	Microscopy and Photomicroscopy C–45	60
Adv. Textile Chemistry and Dyeing Lect. C–44	30	Electives or Thesis C–52	90
Chemical Textile Testing C–43	45	Organic Laboratory II C–41	75
Colloid Chemistry C–50	30	Quantitative Analysis C–46	15
Industrial Chemistry C–42	30	Report Writing C–47	15
		Technical German C–40	30
		Textile Marketing B–42	30

Fourth Year. Second Term

Advanced General Chemistry C–49	30	Organic Laboratory II C–41	105
Adv. Textile Chemistry and Dyeing Lab. C–44	120	Rayon Manufacturing C–51	30
Adv. Textile Chemistry and Dyeing Lect. C–44	15	Seminar in Business English E–40	15
Chemical Textile Testing C–43	45	Technical German C–40	30
Electives or Thesis C–52	90	Technology of Wool Manufacture Fibers G–40	15
		Textile Literature C–48	30

Course VI.—Textile Engineering

This course is the four-year general textile course leading to the degree of Bachelor of Textile Engineering (B.T.E.), and aims especially to fit men, in the broadest possible manner, to meet the increasing demands of every branch of the textile industry for men with combined textile and technical preparation. The magnitude and scope of the textile and allied industries fully justify the most thorough technical training possible for all who aspire to leadership in this field.

The course is planned so as to provide a foundation in those subjects which are essential to the training of an engineer, coupled with a thorough understanding of textile processes and materials. Such subjects as mathematics, physics, chemistry, drawing, mechanics and mechanism, provide for the first objective. The second is secured by a study of cotton, woolen and worsted yarn manufacturing, textile designing, weaving, knitting, dyeing, and finishing. Instruction is by means of lectures, recitations and laboratory work.

A large proportion of the student's time is spent in well equipped textile departments where he is familiarized with the machinery and processes used in the conversion of cotton and wool fibers into yarns and finished fabrics. The subjects of textile testing and microscopy acquaints the student with the methods for determining the physical properties of textile fibers, yarns and fabrics.

To properly equip the student to meet the varied engineering problems which confront the mill manager or executive, or to so train him that he may enter those industries closely allied to the textile, instruction is given by lecture and laboratory practice in the several branches of engineering. Steam engineering considers the problems involved in steam generation and distribution for power, heating and manufacturing purposes, and includes the testing of laboratory and power plant equipment. The course in electrical engineering treats of the generation and transmission of electrical power, the testing of direct and alternating current machinery, and is intended to acquaint the student with modern practice. Mill engineering familiarizes the student with factory design, construction, heating, lighting, humidification, fire protection, and the arrangement of machinery and buildings for most efficient production and economical power distribution.

The broadening effect of such subjects as English and economics is carried still further in this course by carefully planned courses in business administration, accounting, cost accounting and business law.

During the fourth year the student is required to conduct an original investigation of some textile or allied problem, and to submit the results in the form of a satisfactory thesis before receiving his degree.

The Cotton and Wool Options of the Textile Engineering course have been provided for those students who may desire the breadth of technical training which this course offers but who wish to specialize in either cotton or wool manufacturing. In these optional courses the student's entire time is devoted to the study of that particular fiber which he elects. A demand from the distributing and marketing divisions of the textile industry for properly trained men has led to the establishment of the Sales Option of the Textile Engineering course. This is patterned after the General Course but with more time devoted to such subjects as selling, advertising, marketing, foreign trade and the like. There have also been requests for a four-year degree course in which the design of textile materials should receive the greater emphasis. For this purpose the Design Option of the Textile Engineering course is offered, which, while majoring in textile design, includes other subjects that make a broader course than the one of shorter duration.

In the General Option some recognition is given to those who may wish to lay more emphasis on knit fabrics. This is done by the substitution of knitting laboratory time for a portion of that assigned to weaving laboratory and is dependent on the possibility of arranging for such special cases.

For detailed description of subjects, see page 32. The curricula of the several optional courses will be found on pages 27 to 31.

Course VI.—Textile Engineering (General Course-G)

[For first year see page 17]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Fiber Preparation G–20, 21	120	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	45	Textile Design and Cloth Construction D–22	45
Machine Shop B–26	75		
Mathematics B–20	60		

Second Year. Second Term

Applied Mechanics B–25	45	Mathematics B–20	60
Cotton Yarn Manufacture F–20a	75	Physics B–23	75
Electives F–25		Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Machine Drawing B–21	75		

Third Year. First Term

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	60	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electives F–35		Woolen and Worsted Finishing H–30	75
Electrical Engineering B–31	75		

Third Year. Second Term

Cotton Yarn Manufacture F–30a	60	Mill Engineering B–34	90
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	90	Textile Microscopy B–41	45
Electrical Engineering B–44	75	Textile Testing B–43	60
Mill Engineering B–45	60	Thesis	75

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31a	30
Cotton Finishing H–31	105	Mill Engineering B–45	75
Electives B–48 or F–45		Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	105

Course VI.—Textile Engineering (Cotton Option-C)

[For first year see page 17]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Cotton Yarn Manufacture F–20a	180	Textile Chemistry and Dyeing Lecture C–20	30
Machine Drawing B–21	90	Textile Design and Cloth Construction D–20	90
Mathematics B–20	60		
Physics B–23	75		

SECOND YEAR. SECOND TERM

Applied Mechanics B–25	45	Power Weaving D–24	60
Cotton Yarn Manufacture F–20a	135	Textile Chemistry and Dyeing Lect. C-20.	30
Machine Drawing B-21	45	Textile Design and Cloth Construction D–20	75
Mathematics B–20	60		
Physics B–23	75		

THIRD YEAR. FIRST TERM

Applied Mechanics B–30	45	Heat Engineering B–32	75
Cotton Yarn Manufacture F–30a	180	Machine Shop B–26	45
Economics E–30	45	Power Weaving D–32	60
Electrical Engineering B–31	75		

THIRD YEAR. SECOND TERM

Cotton Yarn Manufacture F–30a	180	Heat Engineering B–33	90
Economics E–30	45	Mill Engineering B–34	90
Electrical Engineering B–31	75	Power Weaving D–32	45

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Marketing B–42	30
Cotton Organization F–32	105	Textile Microscopy B–41	45
Electrical Engineering B–44	75	Textile Testing B–43	60
Mill Engineering B–45	30	Thesis	90

FOURTH YEAR. SECOND TERM

Business Administration B-46	90	Mill Engineering B–45	30
Cotton Finishing H–31	105	Mill Illumination B–47	45
Electrical Engineering B–44	75	Thesis	75
Knitting F–31	105		

Course VI.—Textile Engineering (Wool Option-W)

[For first year see page 17]

Second Year. First Term. (Hours of Exercise)

Fiber Preparation G–20, 21	225	Mathematics B–20	60
Machine Drawing B–21	90	Physics B–23	75
Machine Shop B–26	45	Textile Chemistry and Dyeing Lecture C–20	30

Second Year. Second Term

Applied Mechanics B–25	45	Physics B–23	75
Fiber Preparation G–20, 21	195	Power Weaving D–24	75
Machine Drawing B-21	45	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60		

Third Year. First Term

Applied Mechanics B–30	45	Power Weaving D–32	60
Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–32	75		

Third Year. Second Term

Economics E–30	45	Worsted Yarn Manufacture G–30	150
Electrical Engineering B–31	75	Woolen and Worsted Finishing H–30	75
Heat Engineering B–33	90		
Mill Engineering B–34	90		

Fourth Year. First Term

Accounting B–40	90	Textile Marketing B–42	30
Electrical Engineering B–44	75	Textile Microscopy B–41	45
Mill Engineering B–45	30	Textile Testing B–43	60
Textile Design and Cloth Construction D–21	75	Thesis	120

Fourth Year. Second Term

Business Administration B–46	90	Mill Illumination B–47	45
Electrical Engineering B–44	75	Textile Design and Cloth Construction D–21	60
Knitting F–31	105	Thesis	120
Mill Engineering B–45	30		

Course VI.—Textile Engineering (Design Option-D)

[For first year see page 17]

SECOND YEAR. FIRST TERM. (HOURS OF EXERCISE)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

SECOND YEAR. SECOND TERM

Cotton Yarn Manufacture F–20a	60	Power Weaving D–24	75
Fiber Preparation G–20, 21	90	Textile Chemistry and Dyeing Lect. C-20	30
Mathematics B–20	60	Textile Design and Cloth Construction D–20, 21	105
Physics B–23	75		
Knitting F–25	30		

THIRD YEAR. FIRST TERM

Color D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Knitting F–25	45		
Power Weaving D–32	75		

THIRD YEAR. SECOND TERM

Color D–33	45	Textile Design and Cloth Construction D–30	75
Dynamic Symmetry D–34	30	Worsted Yarn Manufacture G–30	90
Cotton Yarn Manufacture F–30a	60	Woolen and Worsted Finishing H–30	75
Economics E–30	45		
Power Weaving D–32	105		

FOURTH YEAR. FIRST TERM

Accounting B–40	90	Textile Marketing B–42	30
Decorative Art D–42	45	Textile Microscopy B–41	45
Jacquard Design and Weaving D-40	90	Textile Styling B–50	30
Textile Design and Cloth Construction D-41	75	Textile Testing B-43	60
		Thesis	60

FOURTH YEAR. SECOND TERM

Business Administration B–46	90	Textile Design and Cloth Construction D-41	90
Cotton Finishing H–31	105	Thesis	135
Jacquard Design and Weaving D-40	105		

Course VI.—Textile Engineering (Sales Option-S)

[For first year see page 17]

Second Year. First Term. (Hours of Exercise)

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lecture C–20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	210
Mathematics B–20	60		
Physics B–23	75		

Second Year. Second Term

Cotton Yarn Manufacture F–20a	60	Textile Chemistry and Dyeing Lect. C-20	30
Fiber Preparation G–20, 21	90	Textile Design and Cloth Construction D–20, 21	105
Mathematics B–20	60		
Physics B–23	75		
Power Weaving D–24	105		

Third Year. First Term

Color D–33	30	Textile Design and Cloth Construction D–30	105
Cotton Yarn Manufacture F–30a	60	Worsted Yarn Manufacture G–30	90
Economics E–30	45	Woolen and Worsted Finishing H–30	75
Power Weaving D–32	75		
Principles of Marketing B–35	45		

Third Year. Second Term

Color D–33	30	Statistics B-53	45
Cotton Yarn Manufacture F–30a	75	Textile Design and Cloth Construction D–30	75
Economics E–30	45	Worsted Yarn Manufacture G–30	90
Marketing Methods B–36	60	Woolen and Worsted Finishing H–30	75
Power Weaving D-32	30		

Fourth Year. First Term

Accounting B–40	90	Textile Microscopy B–41	45
Principles of Selling and Advertising B–49	105	Textile Styling B–50	30
Selling Policies B–52	45	Textile Testing B–43	60
Jacquard Design and Weaving D–40	45	Thesis	105

Fourth Year. Second Term

Business Administration B–46	90	Knitting F–31	75
Cotton Finishing H–31	105	Selling Policies B–52	45
Foreign Trade and Economic Geography B–51	45	Thesis	165

SUBJECTS OF INSTRUCTION

TEXTILE ENGINEERING DEPARTMENT—B

The various options are designated by G, C, W, D, S.

Mathematics—B-10. Preparation: Admission Requirements. The work in the first term consists of algebra, plane trigonometry, and instruction in the use of the slide-rule. Algebra is reviewed through quadratics and then logarithms are taken. In plane trigonometry, right and oblique triangles are solved by means of natural and logarithmic functions, and the various algebraic relations among the trigonometric functions are proved and used in identities and equations. Significant figures and the use of approximate data in calculations are also discussed.

In the second term the following topics are taken up: graphical and mathematical solution of quadratic and simultaneous equations, theory of equations, partial fractions, Naperian logarithms, equations of the straight line, equations of various curves, differentiation of algebraic functions, and applications of the derivative. [All courses.]

Physics—B-11. Preparation: Admission Requirements. Taken simultaneously with B-10. This subject is required as a necessary preparation for all courses, and is given during the first term of the first year. The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this course are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its applications, parallelogram and triangle of forces with applications, resolution and composition of forces, the mechanical principles represented by the wheel and axle, differential pulley block, common pulley blocks, jackscrew, worm and wheel, inclined plane, hydrostatics, elements of hydraulics, kinetic energy, circular motion and harmonic motion.

Laboratory. This course is supplementary to the lecture course and gives the student an opportunity to apply the knowledge gained in the lecture course by performing various experiments. [All courses.]

Mechanism—B-12. Preparation: B-10 and B-11. This subject is also deemed to be one of those absolutely essential to every student's preparation for the work of the following years. Whereas the principles studied are of general application, textile machinery in particular furnishes an unusually large variety of specific examples, and frequent reference is made to these in the development of the course. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, linkages, epicyclic gear trains, and intermittent motion devices. [All courses.]

Mechanical Drawing—B-13. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is taken during the first year and consists of work in the drawing room supplemented by lectures. This subject is considered of the greatest importance as a preparation for the student's future work, and the practical usefulness of drawing of this character is fully emphasized.

This course is systematically laid out covering in order the following divisions:—care and use of drawing instruments; lettering; geometrical constructions; orthographic projection; isometric projection; cross sections; dimensioning; sketching practice on machine details; working drawings; tracing and blueprinting; developments with practical application. [Courses I, II, III, VI.]

Machine Drawing—B-13a. Preparation: Admission Requirements. Taken simultaneously with B-11. This course is similar to B-13, but not so extensive, and is given to students electing the Chemistry and Textile Coloring course. [Course IV.]

Mathematics—B-20. Preparation: B-10. This subject is a continuation of the first year subject B-10, and extends throughout the second year of the engineering course. In the first term the following topics are treated:—derivatives and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals,

summation by integration and applications of integration. In the second term the topics are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, empirical formulas, and nomographic charts. [Course VI.]

Mathematics—B-20a. Preparation: B-10. This subject is a continuation of the work of the first-year subject B-10. A study of the derivatives and differentials is followed by applications of the differential to rates and errors. Other topics treated are the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic, and trigonometric functions. [Course IV.]

Machine Drawing—B-21. Preparation: B-10, B-12, B-13. The work in Machine Drawing is devoted to working detail drawings of textile machinery and advanced graphical mechanism problems. In every case the data for all of these problems are taken directly from some of the textile machines that the students use in other departments. [Course VI, Options G, C, W.]

Physics—B-23. Preparation: B-10 and B-11. This subject lays the foundation for later work in engineering and chemistry and also explains the general application of the laws and principles of physics. Instruction, consisting of lectures, demonstrations, and recitations, is given for three hours per week during the second year. The topics taken up the first term are:—wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are:—reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis.

LABORATORY. A two-hour period per week for Course VI and a three-hour period every alternate week for Course IV accompanies the class work in this subject and is planned to illustrate precise methods for measuring various physical quantities. [Courses IV, VI.]

Physics—B-23a. Preparation: B-10 and B-11. This subject consists of the same topics as B-23 but does not contain any laboratory work. [Courses I, II, III.]

Steam Engineering—B-24. Preparation: B-12. This course consists of thirty lectures given in the first term of the second year. Its aim is to give those students who do not take the Textile Engineering Course a general knowledge of thermodynamics, the steam engine, steam turbine and gas engine and their auxiliaries, and waste heat reclamation. [Courses I, II, III.]

Applied Mechanics—B-25. Preparation: B-11, B-20. This course is divided into two parts: Graphic Statics and Strength of Materials. The first eight weeks of the semester which is devoted to Graphic Statics consists of the study of mathematical and graphical solutions for any system of forces. Centers of gravity and funicular polygons are introduced followed by roof and bridge truss problems under various conditions of dead, live, wind, and snow loading.

During the second half of the semester and during all the following semester, this course deals with Strength of Materials. So far as time permits, such topics as stress, strain, methods of testing materials, bending moments, shearing force, beam design, torsion, design of shafts, compound beams and columns, combined stresses, and like subjects are considered.

This subject is preparatory to the work in Mill Engineering of both the third and fourth years, at which time its practical value and application are clearly demonstrated. [Course VI, Options G, C, W.]

Machine Shop Practice—B-26. Preparation: B-11 and B-12. Systematic instruction is given in the most approved methods of machine shop practice, the object being to familiarize the student with the proper use of hand and machine tools, and the characteristics of the different materials worked. Particular attention is given to the form, setting, grinding and tempering of tools and the mechanism of the different machines involving certain speeds, feeds, etc. The course is so planned that the instruction in each typical operation shall conform as nearly as

possible to commercial machine-shop practice on textile machinery. The list of tools which appears under "Equipment" in this Bulletin gives an idea of the scope of the work, which includes chipping and filing, tool grinding and tempering, straight and taper turning, screw cutting, drilling and boring, planer work, milling machine work, including gear cutting. [Course VI, Options G, C, W.]

Applied Mechanics—B-30. Preparation: B-25. This is a continuation of Applied Mechanics B-25, and is given during the first term of the third year. [Course VI, Options G, C, W.]

Electrical Engineering—B-31. Preparation: B-23. The elementary principles of electricity and magnetism are considered in the lecture course on physics. Their development and application are taken up in this course in a detailed study of the magnetic and electric circuits during the first period of the first term. The second period is devoted to a study of the principles of direct current machinery. The laboratory work consists of a study of technical electrical measurements and dynamo-electric machinery, determining for the latter their operating characteristics.

The second term is devoted entirely to a study of the principles of alternating current circuits, including vector representation, effective values, power, series and parallel circuits. The laboratory work consists of a study of technical electrical measurements, some meter calibration including that of watt-hour meters and a study of alternating current circuits using electrical measuring instruments. [Course VI, Options G, C, W.]

Electricity—B-31a. Preparation: B-23a. This is a short course given in the third year of the manufacturing courses, and consists of thirty lectures covering briefly and in a general way the theory of direct and alternating current generators and motors. [Courses I, II.]

Heat Engineering—B-32. Preparation: B-12, B-20. The purpose of this course is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures and combustion of fuels. The course consists of thirty exercises given in the first term of the third year. The lectures and recitations are supplemented with illustrative problems assigned for home preparation.

LABORATORY. The principles underlying the subjects of steam engineering, hydraulics and thermodynamics are demonstrated in a practical manner in the work in the Engineering Laboratory, given three hours per week. Greater importance is attached to the development of initiative and responsibility in the student than the mere accomplishment of a large number of carefully planned tests. The character of this work is indicated by the following list of experiments and tests:—

Calibration of scales, tanks, gauges, inductors and counters; barrel, separating and throttling calorimeter tests; heat exchange tests; boiler inspection and measurement; flue gas analysis; dynamometer tests; ejector and injector tests; Rankin's efficiency, actual thermal efficiency and duty tests; expansion of pipes, radiation and pipe covering tests; boiler test; trap tests, feed water heating tests; steam, triplex and centrifugal pump tests. [Course VI, Options G, C, W.]

Heat Engineering—B-33. Preparation: B-32. This course is a continuation of B-32, and consists of forty-five hours of lectures and recitations given in the second term of the third year of the Textile Engineering course. The subjects developed are the kinematics of reciprocating steam engines, steam turbines and gas engines. Special attention is given to the mechanical principles on which the steam engine operates, with detail discussion of the valve gear and governing devices, and the various diagrams used for studying the same. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the course the historical development, classification and types of turbines and gas engines are discussed.

LABORATORY. The character of the work in the Engineering Laboratory, given three hours per week during the second half of the third year, is indicated by the following list of experiments:—

Boiler inspection and measurement; Rankin's efficiency, actual thermal efficiency and duty tests; boiler test; valve setting by measurement and by indicator; condenser test; non-condensing and condensing engine and turbine tests; heating and ventilating fan tests; lap and butt riveted joint test; nozzle test; gas engine test; flow of air and air compressor tests. [Course VI, Options G, C, W.]

Mill Engineering—B–34. Preparation: B–21, B–25. Mill Engineering, as presented in thirty lectures during the third year of the Textile Engineering course, consists of a discussion of the following topics: the investigation of the subsoils for the footing course of the foundation; building materials; design of walls, beams, floors, and construction of windows, doors, stairways and roofs.

Sixty hours of drawing-room and laboratory practice are devoted to plane surveying, contour plotting, cut and fill calculations, setting of batter boards, alignments of shafting and the study from blue-prints of slow-burning construction. [Course VI, Options G, C, W.]

Mill Engineering—B–34a. Preparation: B–21. Mill Engineering, as presented in thirty lectures during the third year of the diploma courses, is largely general in its nature and includes only parts of Course B–34. [Courses I, II.]

Principles of Marketing—B–35. An introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. The course will cover the history and economic importance and functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries as well as the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Lectures and the case method of instruction will be employed. [Course VI, Sales Option.]

Marketing Methods—B–36. Preparation: B–35. A continuation of the Principles of Marketing. The course will be conducted by means of lectures and case problems and discussions. Some of the subjects studied in detail are,—the planning of marketing campaigns, the fluctuations of price and style, forecasting, the business cycle, quotas, market surveys and research, sales planning and control, industrial marketing, and consumer merchandising.

Considerable time will be devoted to the study of current literature and events in the textile field. [Course VI, Sales Option.]

Accounting—B–40. Preparation: B–10 and E–30. The purpose of this course is to acquaint the student with the principles and modern methods of accounting for mercantile and manufacturing businesses. It is not intended to make him a proficient bookkeeper or accountant, but the nature of the subject necessitates a basic knowledge of double-entry bookkeeping, the functions of ledger accounts, and of the use of checks, drafts, notes, vouchers, etc., in ordinary business transactions. This is developed during the summer preceding the senior year by requiring the student to take a course in double-entry bookkeeping, thus saving valuable time during the school year and effectively preparing the ground for the instruction work.

The first half of the course is based on a study of the proper form and content of the balance sheet and profit and loss statement, the principles and problems involved in the correct valuation of asset and liability items, and the related topics of depreciation, reserves, capital, surplus and dividends.

The second half of the course is devoted to cost accounting and is planned to give the student a knowledge of the best cost methods in use at the present time. It includes a thorough discussion of methods of handling and accounting for raw materials, direct labor, the distribution of overhead expenses, normal costs and their predetermination, budgeting, and cost reports and their use. [Course VI.]

Textile Microscopy—B–41. Preparation: B–23. This subject consists of the study of animal and vegetable fibers by means of the microscope and its accessories. It includes methods of illumination, sectioning and mounting, drawing with the camera lucida, measurements of diameter and twist, precision sectioning, and the use of polarized light in the study and identification of fibers. [Course VI.]

Textile Marketing—B-42. Preparation: E-30. This subject covers the problems of marketing textile products, with particular emphasis upon the ultimate consumer. The course will survey the principal marketing channels and marketing methods. Attention is directed to the possibilities of demand creation and demand control, especially through market and style research. Current changes in marketing organization of the industry will be studied and reviewed. [Courses IV and VI, Options G, C, W, D.]

Textile Testing—B-43. Preparation: B-23, F-30 or G-30, D-32. This course is planned to familiarize the student with the latest methods and devices for determining the physical properties and characteristics of textile fibers, yarns and fabrics. The scope of the work is indicated by the following topics: abrasion, absorptability, atmospheric control, bursting, crimp, heat transmission, porosity, regain, resilience, stretch, tear, tensile strength, thickness, twist, waterproofness, precision of measurements, interpretation and presentation of data. These are treated both from the standpoint of commercial testing and of textile research. [Course VI.]

Electrical Engineering—B-44. Preparation: B-31. During the first term a detailed study of the alternator is made, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with acccompanying instruments and devices are studied in classroom and laboratory. The single phase, three-phase and Scott transformers are considered in turn and their various methods of connecting to line and alternators are systematically studied.

In the second term the induction motor and generator are studied with their particular adaptability to the textile industry. The principal starting devices for this motor are thoroughly taken up. The synchronous motor is studied particularly in relation to its ability to correct power factor. In all the work outlined above, the main features are illustrated profusely in classroom demonstrations and laboratory exercises. [Course VI, Options G, C, W.]

Mill Engineering—B-45. Preparation: B-34. This subject, given in the fourth year of the Textile Engineering course, includes many new topics, and at the same time coordinates much of the student's previous work in engineering with his knowledge of textile processes and their requirements. In detail it takes up a study of modern types of mill buildings and problems involved in their construction. Such matters as factory location, machinery layout, power transmission, heating, ventilation, humidification, fire protection and sanitary facilities are also discussed. The student is finally assigned the problem of completely designing a textile mill building and laying out its machinery and equipment so far as time permits. [Course VI, Options G, C, W.]

Business Administration—B-46. Preparation: B-10 and E-30. Recognizing the importance which executive work plays in the management of an industrial enterprise, this course has been placed in the curriculum of the Textile Engineering course in order to acquaint the student with some of the fundamental problems and principles involved, and possibly to reveal to him some of his own capabilities for this type of work. The broad topics considered are types of business organizations, financing, administration, planning, control, personnel, and human relationships. The importance of applied psychology to successful management is stressed. The student is made familiar with some of the tools of management such as purchasing systems, storeskeeping, perpetual inventories, warehousing methods, scheduling, routing, tracing, time keeping, motion studies, time studies, mnemonic symbolizing, graphical records, and wage systems.

Business Law. Under this subject are given lectures, supplemented by the use of a suitable text, on the law governing contracts, sales, agency, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guaranty, and bankruptcy. [Course VI.]

Mill Illumination—B-47. Preparation: B-23. Because of the demand and the necessity for proper lighting of textile mills, this course is offered three hours per week for one term. It consists of three major parts,—photometry, illumination and installation design. Costs and estimates, safety and production are included.

The laboratory exercises include the study and applications of the photometer, Macbeth Illuminometer and foot-candle meter. The concluding work is a design of a lighting installation for a typical mill room, using the school laboratories for this purpose. [Course VI, Options G, C, W.]

Electives—B–48. Students in the second term of the fourth year of the Textile Engineering course will be permitted to elect certain textile subjects as substitutes for part of the time scheduled for engineering subjects. Thus a student is offered an opportunity for specialized study along such lines as will prove most beneficial to him at that time. The selection of elective studies is subject to the approval of the head of the Textile Engineering department and to the possibility of arranging for the same. [Course VI, Option G.]

Principles of Selling and Advertising—B–49. Preparation: B–36. A comprehensive course dealing with the fundamental principles of advertising and selling. The course will cover the psychology of selling and advertising, the legal restrictions in marketing, advertising technique, copy writing, layout, illustrations, advertising campaigns, packaging, advertising mediums, industrial and consumer advertising, creative salesmanship, personality, types of customers, the selling process, supersalesmanship, etc.

Lectures and the case method of instruction will be used. [Course VI, Sales Option.]

Textile Styling—B–50. Preparation: D–30. This course will correlate the technical knowledge of design, acquired previously, to the fluctuations of style design, the creation of fads and the forecasting and planning of styles. [Course VI, Options D, S.]

Foreign Trade and Economic Geography—B–51. Preparation: E–30. The course will cover the foreign markets for finished textiles and the American raw fibers, methods of selling employed, foreign commercial law that an American exporter needs, the foreign fibers and textiles and their importance in international trade.

Special emphasis will be given upon costs of foreign marketing, tariffs, international competition, possible markets and methods of building an export business. [Course VI, Sales Option.]

Selling Policies—B–52. Preparation: B–36. This course will cover the development of administrative policies and guiding principles in the marketing, pricing, styling and merchandising of textiles and textile fibers. [Course VI, Sales Option.]

Statistics—B–53. Preparations: B–20. A study of elementary statistics which relate to industry, trade and general business and financial conditions. It includes the analysis, presentation and interpretation of statistical data, index numbers, correlation, law of error, cyclical fluctuations, dispersion, trend and other pertinent topics. [Course VI, Sales Option.]

CHEMISTRY AND DYEING DEPARTMENT—C

Elementary Inorganic Chemistry—C–10. Preparation: Admission Requirements. During the first term of the first year, the class work in this course consists of three lectures, and one recitation per week on fundamental principles, and descriptive chemistry of the non-metallic elements and their compounds. This is accompanied by one afternoon per week of laboratory work, which may be on either inorganic preparations or qualitative analysis, according to the previous laboratory training of the individual student.

In the second term, one lecture and one recitation per week are devoted to the metals and their compounds, and one afternoon per week wholly to qualitative analysis, listed below as C–12. [All courses.]

Elementary Organic Chemistry—C–11. Preparation: Admission Requirements. This course, covered by lectures during the second term, includes a general survey of the fundamental principles of Organic Chemistry, also a study of the hydrocarbons and their derivatives from the point of view of their structure, preparation and uses. This work, although elementary in character, is of sufficient

breadth to prepare the student understandingly for the general lectures upon coal-tar dyestuffs which are given in Course C–20. [All courses.]

Qualitative Analysis—C–12. Preparation: C–10, taken simultaneously. This is a continuation of the laboratory study of inorganic compounds, with application to their systematic analysis. It is given ten hours per week to chemists during the second term of the first year. Students with adequate preparation can make further progress by starting this work in place of elementary laboratory exercises during the first term, as indicated under C–10.

When sufficiently advanced, students take up the examination of various products with which the textile chemist must be familiar such as mordanted cloths, pigments and the various dyeing reagents.

Semi-Micro Qualitative Analysis.—Qualitative analysis for the more common elements by micro methods, with centrifuge, spot tests, etc. [Course IV.]

Qualitative Analysis—C–12a. Preparation: C–10, taken simultaneously. This course is similar to C–12, but not so extensive, being given three hours per week during the second term. [Courses I, II, III, VI.]

Stoichiometry—C–13. Preparation: C–10, taken simultaneously. Two hours per week during the second term of the first year, on the fundamental principles underlying calculations of quantitative analysis, on the gas laws, and on balancing of chemical equations. [Course IV.]

Textile Chemistry and Dyeing—C–20. Preparation: C–10, C–11, B–12, B–13a. The outline of the lecture course which is given during the second year is as follows:—

Technology of Vegetable Fibers.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Animal Fibers.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

Technology of Manufactured Organic Fibers.—Study of the various forms of manufactured organic fibers, including the rayons and such other manufactured fibers as nylon, vinyon and lanital, the process of manufacture, their properties and action with chemicals.

Operations Preliminary to Dyeing.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching; action of soap.

The bleaching of cotton cloth, yarn and raw stock is studied at length with detailed description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is also included an exhaustive study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods for degreasing wool.

Water and its Application in the Textile Industry.—Impurities present, methods for detection, their effect during the different operations of bleaching, scouring, dyeing and printing and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds Used in Textile Coloring and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds, not dyestuffs, that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting assistants, mordanting principles and leveling agents.

Theory of Dyeing.—A discussion of the chemical, mechanical, solution and absorption theories, and the various views that have been advanced by different investigators of the chemistry and physics of textile coloring processes.

Under this heading are discussed the general methods of classifying dyestuffs and the definitions of such terms as textile coloring, dyeing, textile printing, substantive and adjective dyestuffs, monogenetic and polygenetic dyestuffs.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, turmeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used within recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown and iron buff.

Coal-Tar Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Special study of basic coloring matters, phthalic anhydride colors, including the eosins and phloxines; acid dyestuffs, Janus, direct cotton, sulphur and mordant colors, including the alizarines and other artificial coloring matter requiring metallic mordants; mordant acid and insoluble azo colors, developed on the fiber; reduction vat colors, aniline black and other artificial dyestuffs not coming under the above heads.

As each class of dyestuffs is taken up, the details of the methods of applying them upon all the different classes of fabrics and in all the different forms of dyeing machines are thoroughly discussed; also the difficulties which may arise in their application, and the methods adopted for overcoming them.

Machinery Used in Dyeing.—A certain amount of time is devoted to the description of the machinery used in various processes of textile coloring which is supplemented as far as possible by the use of charts, diagrams and lantern slides.

Most of the important types of dyeing machines are installed within the dyehouse of the school, and the students can be taken directly from the lecture room and shown the machines in actual operation. [All courses.]

Dyeing Laboratory—C–21. Preparation: C-20 taken simultaneously. Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various classes of dyestuffs and their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool, silk and the various types of rayon, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye bath, etc.

Bleaching processes applicable to various animal and vegetable fibres are studied.

Work in color matching is also carried out on a laboratory scale. A fairly extensive study of the fastness properties of representative dyes of each class is taken up as well as their suitability for various classes of work.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines which are described elsewhere.

By the use of a small printing machine the principles of calico printing are illustrated, and by means of the full-sized dyeing machines and vats the practical side of the subject is studied. It is the constant endeavor of those in charge to impart information of a theoretical and scientific character that will be of value in the operation of a dyehouse. [Course IV.]

Organic Chemistry II—C–12. Preparation: C–11. The purpose of this course is to lay a broad foundation for the understanding of the basic principles of organic chemistry. The first semester consists of illustrated lectures and recitations covering the aliphatic series. The second term is devoted to the aromatic compounds. A number of problems are assigned as home exercises in order to fix the fundamental principles of the science in the students' mind. Books: J. F. Norris—Principles of Organic Chemistry and E. H. Huntress—Problems in Organic Chemistry. [Course IV.]

Quantitative Analysis—C–23. Preparation: C–12. The object of this course is to teach the fundamental principles of quantitative analysis, and to give the student an opportunity of acquiring skill in manipulating the special apparatus used in analytical procedure.

Typical gravimetric methods are taught the first term. The samples analyzed comprise salts, minerals and ores. Electrochemical analysis is carried out with the aid of a modern type of apparatus designed for rapid work.

The work of the second term consists of volumetric methods. A number of ores and commercial products, carefully chosen, are analyzed so as to give the student a varied experience.

The laboratory work is supplemented by lectures and recitations. Talbot's "Quantitative Chemical Analysis" 1937 Edition is used as a text. [Course IV.]

Stoichiometry—C–24. Preparation: B–10, C–10, C–13. This subject is taken one hour a week during the second year. Calculations of gravimetric analysis are studied the first term, and calculations of volumetric analysis the second term. Hamilton and Simpson's Calculations of Quantitative Chemical Analysis is used as a text. [Course IV.]

Quantitative Analysis—C–30. Preparation: C–23. The fundamental principles acquired in Course C–23 are applied in this course in the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Among the materials analyzed are water, soaps, oils, fuels, and stripping agents. The latest and most practical methods are employed. Mahin's Quantitative Analysis, supplemented by "Analytical Methods for a Textile Laboratory" (as printed in the Year Book of the American Association of Textile Chemists and Colorists) is used as a text. [Course IV.]

Industrial Chemistry—Inorganic—Lecture—C–31. Preparation: C–22. During the second term of the third year lectures and recitations are held in industrial chemistry, the course in general following Riegel's "Industrial Chemistry," Third Edition. Particular attention is paid to the purification of industrial water supplies, the manufacture of heavy chemicals, such as acids, alkalies, bleach liquors, and mordants; the building industry, including the manufacture of Portland cement, glass, iron and steel.

The course is illustrated as far as possible with specimens, diagrams, and charts, and the students are given an opportunity to visit some of the industrial establishments in the vicinity of Lowell and Boston. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–32. Preparation: C–20, C–21. This is a continuation of the Textile Chemistry and Dyeing course of the second year, and includes a review of the second year's work in this subject, with the introduction of many advanced considerations, and in addition, the following subjects:—

Color Matching and Color Combining.—A study of that portion of physics which deals with color and the many color phenomena of interest to the textile colorist. The lecture work is supplemented with the practical application of the spectroscope and tintometer, and much practice in the matching of dyed samples of textile material.

The primary colors both of the scientist and textile colorist, the results of combining coloring lights and pigments, and such subjects as color perception, color contrast, purity of color, luminosity, hue, color blindness, dichroism, fluorescence and the effect of different kinds upon dyed fabrics, are discussed under this heading.

Each student's eyes are tested for color blindness early in the course, in order that he may be given an opportunity to change his course if his eyes should prove defective enough to interfere with his work as a textile colorist.

A dark room has been provided where various experiments in color work and color matching may be performed.

Dye Testing.—This subject includes the testing of several dyestuffs of each class, subjecting them to the common, color-destroying agencies; the determining of their characteristic properties, and their action towards the different fibers; also the determining of the actual money value and coloring power of dyestuffs in terms of a known standard.

Each student is required to make a record of each color tested upon an especially

prepared card, which furnishes a permanent record of all dyestuffs, their dyeing properties, fastness to light and weather, washing, soaping, fulling, perspiration, bleaching, steaming, ironing, rubbing, acids and alkalies.

Union Dyeing.—A study of the principles involved in the dyeing of cotton and wool, cotton and silk, and silk and wool union materials in the production of solid and two-color effects.

Textile Printing.—A thorough study of the whole subject of textile printing, each student being required to produce individually no less than twenty different prints, including the following styles; pigment style, direct printing style, steam style with tannin mordant, steam style with metallic mordant, madder or dyed style, the ingrain or developed azo style, discharge dye style, discharge mordanted style, resist style, indigo printing, aniline black printing.

The different parts of the calico printing machine are thoroughly studied; also the precautions which must be considered in its use, and the arrangement of the dyeing apparatus which must accompany such a machine.

Special attention is paid to the methods of mixing and preparing the various color printing pastes that are used in the above work upon a manufacturing scale as well as experimentally in the laboratory.

Cotton Finishing.—A study of the various processes of finishing cotton cloth and the different materials used therein. The work involves the discussion of the various objects of cotton finishing and such operations as pasting, damping, calendering, stretching, stiffening, mercerizing, beetling and filling, and the various machines used for carrying out these processes.

Dye House and Finishing Plant Management.—A study of the organization and management of the modern bleacheries, dyehouses and finishing plants.

Mill Visits.—During the third and fourth years visits are made to some of the large dyehouses, bleacheries and print works in the vicinity. [Course IV.]

Physical Chemistry—C–33. Preparation: B–10, C–10, C–13. During the third year, three hours per week of lectures and recitations are given on the application of the experimental methods and calculations of physics to chemical phenomena. Students passing this course may supplement it by the optional laboratory course C–42 in the fourth year. [Course IV.]

Organic Chemistry III—C–34. Preparation: C–22. This course (one semester) is a continuation of Organic Chemistry II extending over the alicyclic and heterocyclic series. The lectures also touch upon certain special topics such as general synthetical methods, theoretical considerations, natural products (vitamins, hormones, chlorophyl, the blood pigments, alkaloids), dyestuffs, etc. ([Course IV.]

Technical German—C–35. Preparation: C–20, C–22, E–21. This course consists of the reading of German technical literature with the object of familiarizing the student with the current German publications in textile chemistry and coloring. [Course IV.]

Organic Chemistry Laboratory I—C–36. Preparation: C–20, C–22, C–23. A number of typical organic compounds are synthesized by general methods. A special problem is also assigned to train the student in longer or more difficult syntheses (one semester). Laboratory Book: Gatterman-Wieland—Laboratory Methods of Organic Chemistry. [Course IV.]

Technical German—C–40. Preparation: C–35. This is a continuation of Technical German C–35. [Course IV.]

Organic Chemistry Laboratory II—C–41. Preparation: C–36. The first semester is devoted to the qualitative identification of organic compounds by the Mulliken-Huntress system. The usual quantitative determinations Carius halogen, combustion carbon-hydrogen, molecular weight determinations are taken up in the second half of the year. Laboratory book: Mulliken-Huntress—Identification of Organic Compounds (to appear in print 1940). [Course IV.]

Industrial Chemistry—Organic—C–42. Preparation: C–31. This is a continuation of Industrial Chemistry C–31 and includes the study of the oil, soap, gas, and coal tar industries. [Course IV.]

Chemical Textile Testing—C–43. Preparation: C–21, C–32. A series of lecture and laboratory periods covering the theory and use of the instruments and methods used in testing and evaluating textile materials.

Physical Testing.—Statistical methods, relative humidity, regain, staple, hair weight, fiber resiliency, counts and denier, twist, evenness, cloth count, weight, crimp, thickness, porosity, permeability, waterproofness, wetting out, absorbency, shrinkage, thermal insulating value, handle or draping quality, wear or abrasion, strength and stretch.

Chemical Testing.—Inorganic extraneous matter: ash, ash alkalinity, silk weighting, acids and alkalies. Organic extraneous matter: scouring loss, extraction, sizing and finishing materials. Fiber mixtures: qualitative analysis, quantitative analysis. Swelling and damage in cellulose fibers: qualitative tests, barium activity number, ash alkalinity, solubility in sodium hydroxide, Methylene Blue absorption, copper number, fluidity. Damage to wool: lead acetate test, thiocyanate test, Pauly test, methylene blue test, sulfur content, total nitrogen content, soluble nitrogen, ammonia nitrogen, solubility in dilute alkali. Damage to silk: Zimmermann test, total nitrogen, ammonia nitrogen, viscosity in zinc chloride.

Optical Testing.—Colorimeter, tintometer, pH apparatus, refractometer, spectroscope, spectrophotometer, ultra-violet, infra-red, luster. [Course IV.]

Advanced Textile Chemistry and Dyeing—C–44. Preparation: C–32. This is a continuation of the third-year work in Advanced Textile Chemistry and Dyeing, and includes the following subjects:—

Classification and Molecular Structure of Artificial Dyestuffs.—A study from a more advanced standpoint of the classification and constitution of artificial dyestuffs including the various methods used in their production, also the orientation of the various groups which are characteristic of these compounds and their effect on the tinctorial power of dyestuffs.

The object of this study is to give the student a more complete knowledge of the artificial dyestuffs from the color manufacturer's point of view, which will prove of particular value to those who intend later to enter the employ of dyestuff manufacturers or dealers.

Economics of the Dyeing, Bleaching and Finishing Industries.—A study of the factors to be considered in the establishment of a dyeing, bleaching and finishing plant together with the most essential considerations of its management.

Advanced Dyeing Conference.—During the latter part of his course each student will be required to write, for presentation before the other members of his class, a paper upon some assigned subject of general interest. After presentation the subject will be open to discussion and question.

The object of this conference is twofold. First, to give the student experience and practice in systematically looking up an assigned subject and presenting it before others; and secondly, to bring before the class a greater variety of subjects with more detail than could be covered by the general lectures of the course. [Course IV.]

Microscopy and Photomicroscopy—C–45. Preparation: B–23, C–20, C–22. A course of lectures and laboratory experiments on the use and construction of various types of microscopes and accessories, followed by the preparation of longitudinal and cross-sectional mounts of the various fibers. After a study of the different starches, fibers, and fabrics, a series of unknowns are examined and reported upon.

The lectures also include the subject of photomicroscopy. The laboratory course may be selected by the student as an optional course. [Course IV.]

Quantitative Analysis—C–46. Preparation: C–30. This course consists of lectures, recitations and quizzes on the fundamental principles of analytical chemistry. [Course IV.]

Report Writing—C–47. Preparation: B–20a, E–20. The primary purpose of this course is to enable the student to write a technical report clearly and precisely; to this end it is necessary to present the data efficiently and with due regard to its accuracy. The meaning and determination of significant figures, the applications of statistical analysis, and the preparation and use of graphs are first studied. Suggestions on experimental work and the interpretation of results are then given. Formal and informal, technical and non-technical, laboratory, plant, and consultants' reports are discussed, and practice is given in their preparation. Instruction is also given on the use of the technical literature and the preparation of bibliographies. [Course IV.]

Textile Literature—C-48. Preparation: C-47. The object of this course is to introduce the student to the classical and current sources of information on textile chemical subjects. Each student is given certain references or subjects to report upon, which are sufficiently varied in origin as to make him familiar with the principal reference works and journals of textile chemistry. [Course IV.]

Advanced General Chemistry—C-49. Preparation: C-10, C-12, C-24, C-34, C-42, C-46. The object of this course is more to correlate the various branches of chemistry studied in the previous three and one-half years than to introduce new material. An attempt is made to show the essential oneness of all chemical knowledge. Recent theories are discussed briefly. [Course IV.]

Colloid Chemistry—C-50. Preparation: C-33. A lecture course on general colloid chemistry followed by its applications to textiles.

General.—Adsorption, surface tension and wetting-out, preparation and precipitation of suspensoidal sols, electrophoresis, emulsions, preparation and precipitation of emulsoidal sols, properties of irreversible emulsoids, protective colloids and detergents, gels, amorphous solids, use of X-rays, properties of proteins.

Textile Applications.—Cellulose, swollen cellulose, hydrocellulose, oxycellulose, ligno-cellulose, paper, cellulose esters and lacquers, rayons, silk, wool, silk weighting, mordanting, dyeing, felting of wool. [Course IV.]

The Chemistry of Rayon, Its Manufacture, Bleaching, Dyeing and Finishing—C-51. Preparation: C-32. During the past five years the developments of the bleaching, dyeing and finishing of rayon and other manufactured organic fibers, sometimes referred to as synthetic fibers, have been systematically studied and the curriculum of the Chemistry and Textile Coloring course has been revised from time to time to cover the latest developments in regard to these fibers. A complete unit for the actual manufacture of rayon is available for experimental and demonstration purposes, and the course includes laboratory practice in the manufacture of viscose rayon.

Many of the difficulties which arose during the early days of the so-called artificial silk industry were due to lack of knowledge of its properties and more or less persistent attempts to handle it in just the same manner as real silk. As soon as the textile manufacturer began to fully appreciate the fact that the various rayons were entirely different fibers from true silk and consequently must be handled by different methods, then many extensive improvements were made in the processes of manufacturing textiles containing these fibers. In order to satisfactorily handle the different rayons they must receive a preliminary treatment with various oils and softeners, and as a result the problem of establishing the specifications for the best type of oil to use for this purpose and also the best methods of removing it from the material during the finishing process have been important problems in the development of the industry, and these among others are being studied in the Lowell Textile Institute at the present time. [Course IV.]

Elective Subjects or Thesis during fourth year—C-52. Preparation: Satisfactory completion of all first and second year subjects in Course IV. The value of undergraduate thesis work for all students has frequently been questioned. There is no doubt that many senior students might take elective work of an advanced nature to greater advantage than devoting the same amount of time to specific thesis work. With this in mind beginning 1931-32 several electives were introduced, each elective period being 45 hours per term and four of these being required during the year.

Thesis. If a student has indicated through the first three years of his work that he is capable of handling an original investigation, a definite thesis subject may be assigned to him which will require the entire 180 hours. At the discretion of the Head of the Department, thesis subjects involving one or more elective periods may also be assigned.

In all cases, however, 180 hours' work of an advanced nature, either of thesis work or elective subjects, will be required for graduation.

Photography. A laboratory course in scientific or record photography, including developing, printing, enlarging, preparation of lantern slides, photography of apparatus and procedures, copying, and use of color filters. This course must be taken in preparation for Photomicroscopy.

Photomicroscopy Laboratory. A series of laboratory experiments followed by a research problem in photomicroscopy. The optical system, exposure, and use of color filters is studied and work is done on both fibers and fabrics. Students taking this elective should have had Photography or the equivalent in experience.

Advanced Microscopy. A laboratory course along one or more of the following lines:—

Quantitative microscopy: deconvolution count, classification and grading of wools, quantitative analysis of fiber mixtures.

Polarized light: production, optical effects, uses.

Cross-sectioning: advanced work on methods and refinements in technique.

Colloid Chemistry Laboratory. Experiments illustrating and amplifying the lecture course are performed. These may be on adsorption, hysteresis, surface tension, wetting-out, dialysis, viscosity, protective colloids, emulsification, detergency, gels, swelling, iso-electric point, dyeing.

Textile Chemistry Laboratory. A laboratory course on some branch of textile chemistry of particular interest to the student. This course is usually in the form of directed research.

Microbiology I. This course gives a general survey of the effect of the various micro-organisms on textile materials. Consideration is given to the methods of studying molds and bacteria and the methods of preventing their growth on textiles. In the laboratory the isolation, identification and properties of the organisms are studied. The detection of micro-organisms on fibers and damage to fibers caused by their growth is studied in detail. Methods of testing antiseptics to be used on textiles are also studied.

Microbiology II. A continuation of Microbiology I, laying special emphasis on the branch of microbiology in which the student is most interested. No lectures are given but each student is required to do certain reading and frequent conferences are held with the instructor. In the laboratory each student selects some problem and works it out as thoroughly as time permits.

Rayon. Advanced study of rayon dyeing.

Physical Chemistry. Measurement of molecular weights, heats of reaction, vapor pressure, surface tension, hydrogen ion concentration, electrical conducttivity, etc.

Advanced Preparative Chemistry. The student is required to carry through certain preparations starting with a weighed minimum and handing in a weighed product. The preparations are so chosen as to review the principles of inorganic chemistry and at the same time develop the student's laboratory technique. By basing the grade on quantity as well as quality of product obtained, careful technique is encouraged. Conferences and quizzes are given before and after each preparation. The student is constantly required to apply the principles of previous lecture courses in analytical, inorganic and physical chemistry.

Textile—Chemical Engineering—Preparation: B–11, B–12, B–13, B–23, C–20, C–24, C–42. A combination of lectures and laboratory work designed for the study of the thermal properties of fluids, laws of thermo-dynamics as applied to batch and flow processes, flow of heat, mechanical mixtures, and heat engines.

This course will include such practical applications to the dyeing, printing, and finishing branches of the textile industry as efficient use of steam in heating dye kettles—steam traps—measuring of steam used—calculating steam costs—study of best methods of piping steam for manufacturing purposes and economics of hot water storage.

Compression and fluid handling, testing of pumps, fans and similar chemical engineering equipment including some calibration of instruments will serve to give the student a general over-view of elementary chemical engineering.

Glass Blowing. A course in the elements of laboratory glass blowing, designed to give the man going into laboratory work a familiarity with the methods of handling both soda glass and Pyrex. All the ordinary seals and joints used in construction of apparatus are described and tried out in the laboratory.

Leather Chemistry. This course deals with the chemistry and technology of leather manufacture as well as with the fundamental chemistry of proteins and

enzymatic action. It includes the consideration of high molecular weight compounds, the chemistry of fats and proteins, the action of the leather industry including tanning operations, and various applications of analytical chemistry.

Color Matching. A further study of the principles involved in color matching accompanied by actual matching in the dyeing laboratory of many dyed samples of a variety of colors.

TEXTILE DESIGN AND WEAVING DEPARTMENT—D

Textile Design and Cloth Analysis—D–10. During the first year instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa;* extending and extracting weaves.

This subject takes up in a systematic manner the analysis of samples illustrating the various cloth constructions for the purpose of determining the design of the weave and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric. [First term, all courses.] [Second term, Courses I, II, III, VI.]

Textile Design and Cloth Construction—D–20. For Cotton Goods—Preparation: D–10. During the second year consideration is given to fancy and reverse twills, diaper work, damasks, skip weaves, sateen fabrics with plain ground, backed fabrics, and multiple ply fabrics. Students are required to make original designs and put the same into the loom. Special attention is given to the consideration of color effect.

During the first term free-hand drawing is taught by means of plates, and practice in coloring is given in conjunction with this work.

Practice in lettering, spacing and general arrangement of designs and sketches is given. The engineering alphabet is used in all work.

During the second term instruction is given in drawing, sketching, coloring and designing, with reference to their application in textiles. Good examples of applied design in textiles, as well as in other branches, are used as a basis for modified designs selected and composed by the student. This stimulates originality as well as teaches the student to appreciate good designs and color.

The analysis of these fabrics forms a part of the course in design. This also includes the necessary calculations required to reproduce the fabric or to construct fabrics of similar character. [Courses I, III, VI, Options C, D, S.]

Textile Design and Cloth Construction—D–21. For Woolen and Worsted Goods—Preparation: D–10. During the second year the instruction given includes warp and filling backed cloth, figured effects produced by extra warp and filling, double cloths, multiple ply fabrics, cotton warps, blankets, bathrobes, crepes, filling reversible, Bedford cords, imitation furs, crepons, matelasse and imitations, double plain, ingrains, velvets, corduroys, overcoatings, trouserings.

The analysis of these fabrics, together with the consideration of the shrinkages and dead loss in all fabrics, theory of diameter of yarns, and costs of blends and mixes is a part of this course. [Courses II, III, VI, W, D, S.]

Textile Design and Cloth Construction—D–22. Preparation: D–10. This is a short course covering the elementary principles of designing in general. Instruction is given in the theory of shrinkages and the lay-out of woolen and worsted fabrics, and at the same time similar instruction is given in the design and construction of cotton fabrics. [Course VI, General Option.]

Jacquard Design—D–23. Preparation: D–10. This course, given during the second term, covers detail instruction of the Jacquard machine and the various tie-ups in common use, the layout for different kinds of fabrics, and the cutting of cards in accordance with prepared designs. The adaptation of various designs to woven fabrics through the aid of cross section paper and its correlation with the

different types of looms and Jacquard machines are thoroughly covered. The student is encouraged in original designs and such of these as meet approval are carried out in woven goods. [Course III.]

Power Weaving—D–24. Preparation: D–10. In connection with the work in Textile Design and Cloth Analysis practical work is carried on upon the power looms. This includes the preparation of warps, beaming, dressing, sizing, drawing-in and making of chains, spooling and quilling, and the machinery for the same. A study is made of warpers and sizing machines for cotton, woolen, silk and rayon. Lectures are given to correspond with the progress of the student in the Power Weaving Laboratory covering the following subjects: loom adjustments, chain building, cam looms, automatic shuttle changing looms, dobby looms, single and double acting dobbies, Knowles looms, leno weaving, center selvedge motion, automatic filling changing looms, towel and other pile cloth weaving, Jacquard looms, single and double lift leno Jacquards, Jacquards of special design, the cutting and lacing of cards, and tying up Jacquard harness. The Baker automatic attachment for mixing the filling is also considered. [Courses I, II, III, VI.]

Power Weaving—D–24a. Preparation: D–10. This is a lecture course given during the first term and covers briefly the fundamentals of weaving, types of looms suitable for weaving different fabrics, warp preparation, especially slashing machinery and compounds for rayon, cotton, woolen and worsted yarns. [Course IV.]

Textile Design and Cloth Construction—D–30. Preparation: D–20 or D–21. The advanced work takes up the more complicated weaves adapted to harness work, and leads into leno and Jacquard designs. The following is a brief list of the subject heads, which will give some idea of the course: double plain cloths, ingrains, tricots, chinchilla, tapestry, blankets, upholsteries, spot weaves, pile or plush, crepon, matelasse and its imitations, pique, Marseilles, quilting, and miscellaneous designs for Jacquard, leno, fustian, tissue fabrics and lappets.

Original designs and sketches for particular grades of goods and the study of color effects form an important part of the third-year course. It should be understood that work in decorative art is carried on in conjunction with textile construction and weaving, particularly on the Jacquard loom. Designs of merit are carefully developed in detail and woven into cloth.

The work in cloth construction includes the application of the different weaves and their combinations in the productions of fancy designs, both modified and original; the calculation involved in the reproduction of standard fabrics changed to meet varying conditions of weight, stock, counts of yarn and value; and the discussion of the breaking strength of fabrics and relationship of the construction of the fabric to breaking strength.

Instruction in this subject, which is given by classroom work, is intended to bring together the principles considered under the subject of design, cloth construction, weaving and yarn making of previous years, and to show the bearing each has in the successful construction of a fabric. [Courses III, VI, Options D, S.]

Power Weaving—D–32. Preparation: D–20, D–21, or D–23. Instruction is given in weaving on fancy woolen and worsted looms, single and double acting dobbies, leno weaving, double and single lift Jacquard looms, tying up Jacquard harness, leno Jacquard, harness and box chain building; warp preparation for woolen, worsted, cotton, silk and rayon; formulas for making up different kinds of sizing. Lectures are given to correspond with the same. Automatic shuttle changing looms and automatic filling changing looms are taken up as well as the Baker attachment for mixing filling. [Courses I, II, III, VI.]

Color—D–33. A study of color wheels, values and chromas. Combinations and proportions as well as saturation of color to produce a pleasant effect for the design in question. [Courses I, II, III and VI, Options D, S.]

Dynamic Symmetry—D–34. A mechanical approach to creating patterns suitable for either weaving or printing. The laws of Dynamic Symmetry cut an area in such a way that designs and good composition may be easily developed even by those having little artistic ability. ([Courses III and VI, Options D, S.]

Jacquard Design and Weaving—D–40. Preparation: D–23. Instruction bears particular stress on the sketching of original designs as applied to particular fabrics with reference to the more advanced forms of fabrics and warp tie-ups. In

this work the student not only produces his own sketches but must carry his ideas through to the finished fabric. [Course VI, Options D, S.]

Textile Design and Cloth Construction—D-41. Preparation: D-10, D-20, D-21. The work in this course is the application of the instruction received during the three years previous. Particular attention is given to the layout of designers' blankets. Instruction in the production of new designs is given by the use of design suggestion sheets. As in the Jacquard work the student must not only lay out the blankets but must put them in the loom and work out the various effects for himself. [Course VI, Options D, S.]

Decorative Art D-42. This course is planned to give the fundamentals of design in its application to textiles. It includes such basic subjects as freehand drawing, perspective, historic ornament, and costume design. There naturally follows consideration of fashion trends, changes, and cycles. For those who desire and are qualified a limited course in pattern drafting with some sewing may be given as far as time permits. [Course III.]

LANGUAGE AND HISTORY DEPARTMENT—E

English—E-10. Preparation: Admission Requirements. A technically trained man should be able to express himself clearly, forcibly and fluently, as inability to do so will be a serious handicap to him in after life. The object of the English course is to develop the student's power of expression by a thorough study of the principles of advanced rhetoric and composition, and by constant writing of themes illustrative of the four forms of discourse, viz., description, narration, exposition and argumentation. In addition to the study of rhetoric and composition and the writing of themes, several classics such as are not read in the preparatory schools are studied and discussed. [All courses.]

Elementary German—E-11. Preparation: Admission Requirements. This course is intended for first-year students who do not offer German as an entrance requirement and who desire to take the course in Chemistry and Textile Coloring. It may be selected by students taking the Textile Engineering course who have not fully met the entrance requirements in language. The work is elementary in character, and much time is devoted to the study of the rudiments of German grammar with practice in composition. During the latter part of the year considerable attention is given to the reading of ordinary German prose, which serves as an additional preparation to the student for the later reading of works along scientific and industrial lines. [Course IV.]

English—E-20. Preparation: E-10. The curriculum of this course is based upon the sound belief that the young man about to enter business can profit much by the study of the principles and the rules of standard English as applied to business writing. The student is given a comprehensive remedial review of the fundamentals of grammar in their relation to practical expression in writing letters and reports. Class discussions of actual quoted letters, collateral readings, and home preparation of written assignments afford the student abundant opportunity to enlarge his vocabulary and to improve his style. During the second semester, modern essays and other works of fiction are read and discussed. The course meets twice each week. [Course IV.]

Advanced German—E-21. Preparation: E-11. For students taking the course in Chemistry and Textile Coloring the elementary course of the first year is continued throughout the second year. The work consists of the study of some of the more advanced principles of grammar, and especially of the reading of scientific German, dealing with a variety of subjects, and the translation of commercial German. [Course IV.]

Economics—E-30. Preparation: E-10. This course, meeting three times a week, is conducted by means of lectures, discussions, and recitations, supplemented by textbook reading and study of charts analyzing various phases of industrial problems. The character of the course is descriptive and practical rather than theoretical, and the aim is to acquaint the student with the accepted principles of economics and some of their applications to industrial conditions.

The course will also deal briefly with economic history, showing how the present economic system has evolved from past systems and pointing out how the experience of the past can aid in the solution of present problems.

Besides the historical material, other topics discussed are the nature and scope of economics; the evolution of economic society; the three factors of production, land, labor and capital; the four elements in distribution, rent, wages, interest and profits; business organization; value and price; monopoly; money, credit and banking; international trade; protection and free trade; transportation; insurance; economic activities of municipalities; and public finance. In short, it is an outline course dealing with the fundamental principles that underlie a wide range of activities. [Courses IV, VI.]

Seminar in Business English—E-40. Preparation: E-10. This course is a conference course for those who wish to pursue intensive advanced study in the field of business English. Second semester, one hour each week. [Course IV.]

COTTON DEPARTMENT — F

Cotton Carding—F-20. Preparation: B-10, B-12, B-13. This course extends throughout the second year and includes instruction starting with the growth, classes and characteristics of cotton and continues on through all the mill operations preparatory to spinning.

Cotton Production.—A study of the areas of the world producing cottons and the characteristics of the world's commercial cottons forms the major portion of this division of the work. Particular emphasis is given to the various American cottons. The different methods of ginning and the by-products from the cotton seed are studied here.

Cotton Marketing.—The customary methods of concentrating and distributing raw cotton come under this heading, which includes a study of the handling of cotton for spot sales and through the exchanges. It includes also a study of the classing of cottons, which involves instruction regarding the Federal Standards for classing and the terms commonly used by mills in handling purchases of cotton.

Opening.—The various machines used in opening raw cotton are studied in considerable detail, following which, typical layouts of the various machines in series, as used by different mills, are taken as illustrations of how these machines can be arranged for various conditions.

Picking.—Particular emphasis is used in instructing the student in the new arrangements being developed for the picker room. Such standard subjects as eveners, lap measuring motions, grids and beaters are followed with illustrations of their application to the single process pickers. The effect of varying humidities on proper lap weights and future results in the card room are clearly pointed out under this heading. Draft, production and waste calculations complete the instruction on pickers.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards, that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, as well as the methods of grinding, form a part of the work. The proper procedure for operating cards to get the proper size and production and to keep them in proper mechanical condition to produce good work occupy considerable of the time given to carding. The calculations for draft, production and percent of waste completely cover these subjects as connected with carding.

Drawing.—Under this head is taken up the theory of doublings and their effect upon the quality of roving and yarn. Like previous and subsequent processes the machine construction forms an important part of the work. Proper stress is paid to such subjects as stop motions, drawing rolls and their covering, cleaners and evener motions. The calculations cover draft, production, roll crimp and improvement in uniformity.

Combing.—This process is explained by lecture work and by operation and assembling of the various types of combs in service in the laboratory. The object of combing is fully considered, and the different means employed on the many types of combers on the market is studied. This includes such types as the Heilman, New Whitin, Nasmith, and Saco-Lowell combers. Considerable time is spent in studying the many comb adjustments, their purpose and how they should be used

to produce the desired quality of work. The proper care of the comb is explained. The subject includes the necessary calculations for draft, noilage and production.

Roving.—Under this heading the frames called the slubber, intermediate, fine, jack, and long draft roving are studied. The numerous changes and adjustments necessary to produce good work are stressed, with special emphasis on the less obvious subjects of lay and tension. Both English and American types of frames are used. The cotton system for sizing rovings and yarns is studied here, following which, such calculations as draft, twist, lay, tension and production complete the work of the roving operations.

Laboratory.—An extensive series of laboratory projects are carried out simultaneously with the lecture instruction. These laboratory classes illustrate the principles developed in the class room and extend the class room work to practical application and operation. After work in classing raw cottons, cotton is processed using different adjustments, thus showing the results of the changes. Sufficient quantities of stock are processed so that the roving made is later spun into yarns and manufactured into cloth by the student. [Course I.]

Cotton Carding—F-20a. Preparation: B-10, B-12, B-13. This course is similar to Course F-20, except that there is much less time devoted to lecture and laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F-25. Preparation: B-12, D-10. This course covers the same lectures and laboratory work as F-31. [Course VI, Option D.]

Cotton Spinning—F-30. Preparation: F-20. This course extends throughout the third year and includes instruction on spinning, spooling, winding, twisting, reeling and baling.

Ring Spinning and Twisting.—This part of the course covers all kinds of regular and long draft ring spinning and twisting frames, their construction, principles of their actions and calculations. Particular emphasis is given to the production of yarns for different uses, in order that the desirable characteristics may be obtained. As the twister so closely resembles the spinning frame in many ways, the two operations are studied in succession to avoid duplication. The defects commonly found in yarns and methods of eliminating them require considerable attention. The methods of sizing yarns and the calculations for determining draft, twist and production are important factors in this work.

Mule Spinning.—Although less common than formerly in American mills, the mule is still of sufficient importance to warrant a study of its major motions. The advantages of mule yarns are clearly shown and the more common calculations for draft, twist and production are given.

Spooling and Winding.—These methods of preparing yarns for twisting and warping are fully explained. The machines are studied for the mechanical construction and adjustment. The calculations are largely in connection with production.

Reeling and Baling.—This work covers the winding of yarns into skeins on various types of reels, the calculations for producing skeins of a desired size and the adjustment of stop motions for measuring the desired yardage. The packing of skeins into bales follows the reeling.

Laboratory.—The laboratory work for this course consists of a series of projects particularly intended to illustrate the important features of the various machines and their products. In addition, considerable time is spent in producing yarns in sufficient quantities to give the student some practical experience in operating the machine and handling the rovings and yarns required. [Course I.]

Cotton Spinning—F-30a. Preparation: F-20a. This course is similar to Course F-30 except that there is much less time devoted to laboratory work. [Courses III, VI, Options G, C, D, S.]

Knitting—F-31. Preparation: B-12, D-10. This course, commencing with a study of hosiery yarns and their preparation for knitting, includes a study of the various stitches and their application in commercial fabrics; a study of the different knitting machines, including circular and flat, spring and latch needle machines, used in the manufacture of stockings, sweaters and underwear; and a study of

looping and sewing machines. Part of the work consists of the assembling and adjusting of different types of knitting machines.

In addition, considerable time is spent in the analysis of knitted fabrics. [Courses I, II, VI, Options C, W, S.]

Knitting—F-31a. Preparation: B-12, D-10. This course embraces the same lectures as Course F-31 but does not include any laboratory work. [Course VI, Option G.]

Cotton Organization—F-32. Preparation: F-20 or F-20a. This course correlates all the work in the Department of Cotton Yarns. The student is instructed how cotton yarn mill organizations are made, by the study of actual mill organizations, showing the drafts, doublings and sizes in use. This is followed by the calculation of machinery necessary to equip a given plant and the arrangement of this machinery in the mill building. Some time is given to the study of special equipment not specifically covered in other classes. [Courses I, VI, Options G, C.]

Knitting—F-35. Preparation: F-25. This course, given to students specializing in knitting, includes a more detailed study of hosiery and underwear manufacture with some time devoted to the manufacture of warp knit fabrics. [Course VI, Option G.]

Thesis—F-34. Each student is required to present a thesis which is a report of some original work. This is sometimes the construction of some yarn or fabric to meet certain requirements. At other times the work is a study of some technical problem regarding the effect of certain changes in manufacturing conditions. [Course I.]

Knitting—F-45. Preparation: F-35. This is an advanced course for students who are specializing in knitting. With the approval of the department, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems. [Course VI, Option G.]

WOOL DEPARTMENT—G

Fiber Preparation—G-20. Preparation: B-10, B-12, B-13. Raw Materials.—A study of raw materials which enter into the manufacture of woolen or worsted yarns, or which are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel's hair, cotton, flax, hemp, jute and ramie.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lecture and by actual sorting of fleece wool under the direction of an experienced wool sorter. The various characteristics and properties are explained, as are also trade names, such as picklock, XXX, XX, ½-blood, ⅜-blood, ¼-blood, delaine, braid, etc. Some skill is acquired in the estimation of shrinkage and in judging the spinning qualities.

Wool Scouring.—The object of scouring and the methods employed are explained, and this involves the consideration of the soaps and chemicals used in scouring; also the waste products and their utilization. Actual work is done in scouring a commercial quantity of wool by machines that are made similar in operation to regular commercial machines. A study is made of the effect of the hardness of water upon soap; also tests are made to show this effect. At the same time the use of dryers, their operation and regulation, is taken up.

Carbonizing.—The various methods of stock carbonizing are explained in detail in the lecture course. Actual carbonizing of noil, burr waste, and defective wool is carried out by the sulphuric acid method on commercial size machines in the laboratory.

Top Making and Combing.—This branch takes up in all detail the carding of wool on a worsted card, the preparing processes, back-washing and Vigoureaux printing, also gilling of the stock before and after combing. The construction of the gill boxes and combs is studied by lectures and by dismantling and assembling

these machines in the laboratories. Later, quantities of stock are made into top and then into yarn.

The Noble comb is studied, and the various calculations to determine draft, noiling, tear, productions, etc., are made. [Courses II, III, VI, Options G, W, D, S.]

Woolen Yarn and Shoddy Manufacture—G–21. Preparation: B–10, B–12, B–13. Reworked Fiber or Shoddy.—Rags of all kinds are studied, sorted, and all processes necessary to convert them into fiber are covered in detail.

Wool Blending, Oiling and Picking.— Mixing and shading of colors and qualities of wool are studied and practiced. The details of Burr Pickers and mixing pickers including the Fearnaught are studied in full. The importance of oils and emulsions is stressed in lecture and laboratory.

Woolen Carding.—The system of carding wool for woolen yarn is fully explained, as is also the construction, setting and operation of the cards. A part of the work is the reclothing and grinding of the cylinders, strippers, workers, etc. The carding of suitable and commercial quantities of wool, and the further manufacture of it into yarn, serves to fix the principles of carding in the mind of the student, as well as to give him some skill in handling machinery.

Woolen Spinning—The computations necessary in converting roping into yarn are fully explained. The details of construction and operation of the spring and cam type mule are well covered in lectures and practice. The theory and practice of continuous or ring spinning for woolen is also taken up. The conditioning of yarn after spinning by steaming is explained.

Costs and details of a yarn mill are mentioned in brief as well as some causes of poor yarn and its effect on mill production. [Courses II, III, VI, Options G, W,D,S.]

Worsted Yarn Manufacture—G–30. Preparation: G–20. Intersecting Gill Boxes and French Comb.—The equipment of the laboratory offers opportunity for the production of dry-combed top and its comparison with oil-combed top produced on the Noble comb. The structures and uses of intersecting gill boxes and the study of combing and drawing blends is taken up at this point.

Drawing and Spinning.—The laboratory equipment consisting of the Bradford (English) system of drawing, of both open and cone types, as well as the various processes of French drawing, followed by both worsted mule and ring spinning frame, make possible a thorough study of the manufacture of worsted yarn by all of the existing methods.

The same method of study of mechanisms, calculations, and operations of the various machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

Organization.—At the end of the course the layout of a properly balanced yarn mill is studied, and at the same time the cost of machinery, depreciation, labor costs and machinery arrangements.

Thesis.—Before graduation the student must present visible evidence of his knowledge of woolen and worsted manufacture by the production of twenty yards of fabric from his own design (or reproduction or modification of some existing fabric) beginning with the raw material.

A formal typewritten description, including all calculations and observations, together with samples from each machine, must be presented to the head of the department before the final examination. [Courses II, III, VI, Options G, W, D, S.]

Textile Testing—G–31. Preparation: B–23, F–30 or G–30, D–24. The object of this course is to familiarize the student with present-day methods of determining the physical properties of textile fibers, yarns and fabrics. The application of physical laws and methods of measurements, as studied in the course of Physics, is used in the study of physical characteristics of textile material. The work is given to students in advanced courses, and consists of lecture and laboratory work. Reports are prepared from each experiment, giving the object of the experiment, method of procedure, observation and conclusions, in order that the student may acquire practice and understand the interpretation of data. A special testing laboratory is provided, and a considerable number of the best standard

fiber, yarn and fabric testing instruments of foreign and American make have been installed and are used for instruction in the testing of textile materials. The laboratory is equipped with means for making and keeping the humidity constant, so that tests can be made under uniform or standard conditions of humidity and temperature. [Courses I, II, III.]

Technology of Wool Manufacture—Lectures and Demonstrations—G-40. Preparation: C-21, C-32, D-10. This course is planned to supplement the instruction already given in design, cloth construction, chemical technology of fibers, scouring, dyeing and finishing, with sufficient lectures and demonstrations in sorting, scouring, backwashing, gilling, combing, top-making, English drawing, spinning, twisting, warping, and weaving, to make the processing of grease wool and allied fibers into ordinary worsted spun yarn fabrics, clear as to object and continuity.

The manufacture of virgin and reworked wool into woolen spun fabrics, with scouring, carbonizing, mixing, picking, carding, spinning, twisting, warping and weaving is also given. Illustrated descriptions of the manufacture of hardened, woven and needle loom felts are taken up.

Mechanical details and calculations are subordinated to familiarizing the student with the nature and object of the several processes. [Course IV.]

FINISHING DEPARTMENT—H

Woolen and Worsted Finishing—H-30. Preparation: B-12, C-10, D-10, D-24. The outline of this course, which is given by means of lecture and laboratory work, is as follows:—

Burling and Mending.—Under this head is taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are all considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the early types of stocks, hammer falling and crank stocks, and their modifications and development into the present type of rotary fulling mills of both the single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, methods of covering, regulation and means of adjusting the pressure of traps and rolls, consideration of the shoes, the use and regulation of the various types of stop motion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure. moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the reduction of various degrees of felt as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, shoddies and mixed goods, is studied in classroom and by operation in the mill.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods both before and after the fulling process; the various types

of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and scours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects, wrinkles and unclean goods, are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions, and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping, Steaming, Singeing and Crabbing.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing, and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year. [Courses II, III, IV, VI, Options G, W, D, S.]

Cotton Finishing—H–31. Preparation: B–12, C–10, D–10, D–24. The outline of the course in the finishing of cotton fabrics is as follows:—

Cloth Room.—Instruction of the various goods and the object thereof; construction of the various types of inspecting and trimming machines.

Shearing.—The object. A consideration of the various types of shears for treating one or both sides at the same time; also the use of the usual cleaning devices, such as emery, sand and card rolls, beaters and brushes; grinding and the adjustment of the various parts.

The use of brushing and cleaning machines, rolling devices and calender attachments for gray goods.

Singeing.—Developing and object of singeing; the construction of singers of all types and for various purposes; the use of cooling tanks; steaming devices, rolling and brushing attachments.

Regulation of the flame for various goods, and adjustment of the parts; gas and air pressure, water-cooled rolls; the effect of moisture on the cost of singeing and use of dry cans in connection with singeing; electric singeing.

Washing.—Open width and string washers, their construction and operation; soaps, temperature, squeeze rolls; washing of various goods and the object thereof; stains.

Napping.—The object of napping and the usual method of treating goods; various types of nappers, single and double acting; felting nappers; construction, grinding and adjustments of various types.

Water Mangles.—Their objects and the construction of various types; various rolls, iron, husk, etc.; scutchers, their object and constructions.

Starch Mangles.—The object and construction of all types of starch mangles for pure starch and filled goods; various types of rolls, brass, rubber, wood; action of doctor blades, etc.; regulation and object of pressure.

Methods of starching and finishing all standard goods, also a consideration of the various substances used, such as starch, softener and fillers; the preparation of starch and various methods of application.

Dryers and Stretchers.—Both horizontal and vertical types of drying cans, tenter frames, clips, etc.; the swing motion and the finishes thus produced; object and construction of spraying machines, belt stretchers, short tenters, button breakers, etc.

Calenders.—The object and construction of all types, including the regulation of pressure and nips for the production of various finishes; various types of rolls and their uses,—steel, husk, cotton, paper, etc., the use of hot and cold rolls; chasing, friction, embossing and Schreiner calenders, and the various finishes produced by each; production of watered effects; beetling machines and hydraulic mangles.

Making-up room,—yarding, inspecting; different types of folds: pressing, papering, marking. [Courses I, III, VI, Options G, C, D, S.]

EQUIPMENT

The equipment of machinery, inventoried at $458,000.00, is most varied for textile educational purposes, and is being constantly augmented. The builders of the various machines installed keep in close touch with the Institute, adding to the machines such improvements as are made from time to time. This operates to the mutual advantage of student and manufacturer.

Cotton Yarn Department.—The opening and picking section of this department contains a 50-saw Pratt gin used for experimental purposes. For classing work, there is a specially equipped section with north light, where Universal Standard Grades and Government Staple Standards are available.

The picking equipment consists of a 40-inch Saco-Lowell three beater single process picker.

The card section has three standard revolving flat top cards, one each from Saco-Lowell, Whitin, and Howard and Bullough shops.

The combing section consists of a sliver lapper, one four-head ribbon lapper, one two-head comb, and one eight-head comb, all from the Whitin Machine Works. There is also one two-head Nasmith comb from John Hetherington and Sons of England.

The drawing frames are all of the single head type. There are two four-delivery drawing frames and one railway head from the Saco-Lowell Shops. Another frame of two deliveries is from the Howard and Bullough shops. It has electric stop motions and metallic drawing rolls.

The roving section has a complete equipment, slubber, intermediate, fine and jack frame from the Saco-Lowell Shops. In addition, there is an intermediate frame made by the Woonsocket Machine and Press Company, and a fine frame from Howard and Bullough.

The spinning equipment is quite varied both with respect to builders and with respect to types and sizes. The Saco-Lowell Shops have supplied five different frames varying from 36 to 216 spindles. They are suitable to spin counts from 3s to 80s. One is equipped with the Saco-Lowell Roth long-draft system, while another has a special five-roll, long-draft system built in the Institute. A sixth Saco-Lowell frame was supplied by the Acme Machine Company equipped with Chapman ball-bearing spindles. The Whitin Machine Works is represented by three frames on which counts from 3s to over 100s can be spun. One of these frames has an auxiliary equipment of SKF roller-bearing spindles and is fitted on one side with Casablanca long-draft equipment. The Howard and Bullough shops have one spinning frame suitable for counts from average to fine. This is equipped with an English type of builder which distinguishes it from the other frames. One Fales and Jenks frame is present, equipped on one side with the Casablanca long-draft system. One spinning mule has been retained to illustrate this peculiar type of spinning. It is from Asa Lees Company of England and is suitable for counts above 30.

There is one short spooler from the Saco-Lowell Shops. There are two winders from the Foster Machine Company, one for single ends either on cones or tubes, the other for one, two, or three ends parallel wound, especially for preparation for twisting. There is also a one gang Universal No. 50 winder with individual drive suitable for winding ordinary tubes or Franklin Process packages.

The twisters are suitable for all counts. There is one each from the Saco-Lowell, the Howard and Bullough, and the Fales and Jenks Shops. These are all equipped for either wet or dry twisting of average and fine counts. There are two twisters from the Draper Corporation. These are equipped for wet or dry twisting for coarse counts or heavy plies.

The department has a complete coiler waste system as made by the Saco-Lowell Shops, consisting of a 40-inch single coiler side delivery breaker card; a 40-end derby doubler; a 40-inch four coiler finisher card; a combination slubber-intermediate and a waste spinning frame. The cards are both equipped with Chapman neutralizers intended to overcome any trouble originating from static electricity.

To prepare mill wastes for re-use there is one single cylinder roving waste opener and one thread extractor, both from the Saco-Lowell Shops.

With the exception of the opening-picking room the humidity in this department is controlled automatically by a system installed by the American Moistening Company. Seven high duty heads supply the necessary moisture and air circulation. An adjustable automatic control regulates the humidity to the desired per cent.

The experimental laboratory is equipped with a power driven skein tester for determining yarn strength and a Moscrop single thread tester for single end strength. There are twist counters for determining the amount of twist and the twist contraction. For fine work and for fiber study, there is an analytical balance and a Spencer microscope equipped with three objectives, three oculars, ocular micrometer, mechanical stage and Abbé condenser.

Knitting Section.—The winders for this section include a six-spindle No. 50 cone winder, equipped with swifts for winding from skeins, suitable for fine cotton, worsted, silk and rayon yarns, and a Payne bobbin winder suitable for coarse woolen, worsted and cotton yarns.

In the automatic hosiery machine section are included three Banner machines,—220 and 200 needle full hose machines and a 160 needle half hose machine; four Scott & Williams Machines,—a 200 needle B–5, a 220 needle Model K, a 220 needle HH and a 160 needle RI. This section also includes two Acme stationary cylinder machines, a Mayo model C full automatic and a Brinton footer. For fundamental instruction a Branson 80 needle hand machine is included. For hosiery legs and tops there are five ribbers, made by the Wildman Company, with cylinders varying from 3½–5¼ and arranged for needles varying in number from 160–240; two Brinton ribbers, one arranged for 176 needles and the other 200 needles; one Brinton tie machine, 1¾-inch cylinder 100 needles and 49 needles; one Universal Ribber 3½-inch diameter, 160 needles. To illustrate the fully fashioned type of knitting hosiery there is an 18 section, 39 gauge Reading legger, with topping stand.

The underwear machinery consists of one Crane spring needle machine, two head Tompkins spring needle machine, one Scott & Williams ribber, and one Wildman ribber.

Under the group of flat machines there are three Lamb machines, one arranged for knitting gloves and one arranged for knitting sweaters. In addition to these there is also a Grosser sweater machine, a Jacquard machine, and a link and link machine; a Dubied scarf machine; and a Raschel warp knitter.

For finishing work this section includes a Grosser 2-thread looper, one Hepworth looper, two Beattie loopers, a Sotco 24-point looper with an individual table and motor drive; five Union Special sewing machines for overseaming, double stitch covering, seaming and welting and vest finishing; six Merrow sewing machines, including two shell stitch machines and three overseaming and crocheting machines; three Singer machines; three Wilcox & Gibbs sewing machines, including a flat-lock machine.

The Philadelphia Metal Drying Form Company has installed a table of six forms including men's, women's and children's.

For instruction in the manufacture of braids the New England Butt Company has installed one 24-line Hercules braider, one 12-line braider, one tubular braider, and one soutache braider.

Woolen Yarns Division. — The following machinery and equipment is available for use in the manufacture of yarn on the woolen principle.

Installed by Davis & Furber Machine Company: One wool mixing picker equipped with hopper feed (George S. Harwood & Son), one modern 60x40 three cylinder set of cards, single breaker and double finisher, each driven by Westinghouse variable speed motors through silent Whitney chains, improved Bramwell breaker feed by Harwood & Sons, Davis and Furber Broadband intermediate feed and 80 end four bank single apron tape condenser with all change gears and pulleys; one set 48x40 cards with single breaker, intermediate, and finisher cylinders, Bramwell breaker feed, latest type Apperly-Harwood transfer feeds with 40 end ring doffers and two apron condenser; one Model B latest type woolen ring spinning frame, motor driven, with 60 spindles 2½-inch rings; one 120 spindle spring mule with bobbin holders by the American Bobbin Holder Company.

Installed by C. G. Sargent's Sons Corporation: One multiplex burr picker for medium wools, one yarn conditioning machine with motor drive.

Installed by Johnson and Bassett, Inc.: One 120-spindle cam mule complete.

Installed by Torrance Manufacturing Company: One sample mixing card for blending and matching wool.

Installed by B. S. Roy & Son: One card grinding stand with two traverse grinders complete.

Shoddy or Reworked Fiber Division. — Installed by C. G. Sargent's Sons Corporation: One cypress screw acid dip tank; one single apron dryer (baker); one cone carbonizing duster with crush rolls.

Installed by Schaum & Uhlinger, one steam hydro-extractor.

Installed by C. S. Dodge of Lowell, one ball bearing rag picker with condenser, one bagging stand.

Installed by John T. Slack Corporation are hundreds of samples of reworked wool in all stages from rags to fiber.

Wool Preparing Division. — Wool sorting and grading is carried on under excellent conditions with the following equipment: sorting bench, baskets, bagging stands, etc.

Installed by C. G. Sargent's Sons Corporation: One grease wool cone duster, one four bowl scouring train with large hopper feed; one single apron dryer with large feeder.

Top Making Division.—Top for the Bradford or French system is made with the following machinery: One double cylinder worsted card (four licker-in) with can coiler and balling head, complete, by Davis & Furber Machine Company, and with a Bramwell automatic feeder supplied by George S. Harwood & Sons. An electric neutralizer is furnished on card by the Chapman Electric Neutralizer Company. This section also includes a double bowl, 5-cylinder backwasher, with gill box, Taylor-Wordsworth & Co., equipped with blueing motion, oiling motion, and Layland patent pressure motion; a weigh gill box and creel and one doubling balling head gill box (with double screws) made by the Saco-Lowell Shops; two worsted combs with baller punch, one made by Crompton & Knowles, and the second made by James Smith & Sons; two finishing gill boxes, one known as a can gill box and the other a balling head gill box, both made by Hall & Stells.

Worsted Yarn Division.—Bradford or English System: For the manufacture of yarns under the Bradford System of Drawing, Spinning, and Twisting, the following machinery as made by Prince Smith & Son, make up the equipment: one revolving creel for 12 balls, one 2-spindle drawing box, one 4-spindle first finisher, one 12-spindle dandy reducer, one 12-spindle cap frame, one double head can gill box, one 2-spindle gill box, one 2-spindle flyer frame, one 12-spindle ring frame, one 12-spindle 2-fold cap twister, one 12-spindle 6-fold ring twister. One 36-spindle ring spinning frame with motor drive has been installed by Whitin Machine Works. In addition to this the Saco-Lowell Shops have installed the

following machinery to carry on similar work: one 2-spindle drawing box, one 6-spindle second finisher, one 24-spindle dandy rover, one 6-spindle cone reducer, one 8-spindle cone rover, one 48-spindle cap spinner, 5-foot end, one 48-spindle cap spinner, 4-foot end, one 48-spindle Boy ring twister. The Universal Winding Company has installed one of its 6-gang winders, equipped for cones or straight tubes. The Lindsay-Hyde Company has installed a modern skein winder.

The humidity in the laboratory as well as in the testing laboratory of the woolen yarns and of the English system of worsted yarns is maintained by the American Moistening Company's system of six humidifiers and four Comin's High Duty heads, under automatic control.

French System.—For the manufacture of worsted yarns under the French System of Drawing and Spinning the machinery was made by the Société Alsacienne de Constructions Mechaniques, and the equipment consists of the following: Model P. L. B. comb with creel for 24 doublings, intersecting gill box (2 heads) equipped with oiling device, gill box (2 heads), first drawing (2 heads), second drawing (2 heads), third drawing (2 heads), reducer (4 porcupines), slubber (8 porcupines), first intermediate (8 porcupines), second intermediate (8 porcupines), rover (8 porcupines), finisher (16 porcupines), self-acting worsted mule (150 spindles).

The Saco-Lowell Shops built and installed a ring spinning frame of 60 spindles for worsted yarns equipped with individual General Electric Company's motor and a Reeves Variable Speed Transmission.

Twenty-one turbo humidifier heads automatically controlled by a humidity regulator have been furnished by the G. M. Parks Company. The compressed air for these heads is supplied by an Ingersoll-Rand 8 by 8 steam-driven air compressor.

Textile Testing Division. — Complete equipment is available for testing all kinds of fibers and fabrics under controlled conditions for breaking strength, elasticity, elongation, physical structure, moisture content, oil content, thickness, bursting strength, count of yarn, yards per pound, twist, resistance to abrasion and other tests of commercial or experimental importance. This equipment includes the necessary microscopes and micrometers, a skein-testing machine, and electric conditioning oven made by the Emerson Apparatus Company; single yarn and fabric strength-testing machines made by G. R. Smith & Company; a strength-testing machine, capacity 500 kilograms, for testing twines and fabrics; a fiber-testing machine for testing fibers and fine yarns with capacity, 1 gram to 1.5 kilograms; a yarn strength-testing machine with capacity 1,000 to 5,000 grams; and a yarn strength-testing machine with capacity 5 to 30 kilograms, all of which have been made by Louis Schopper. In addition to these there is a standard yarn and fabric testing machine made by Henry L. Scott & Company, a Mullen Tester, a special abrasion machine for testing the resistance to wear of carpets and other pile fabrics, one General Electric mercury vapor lamp with stand for top inspection, one Edgerton stroboscope.

Design and Power Weaving Department.—In the fabric analysis section there have been provided chemical balances made by Voland & Sons and Christian Becker, necessary twist testers, microscopes, reels, etc., as well as a Torsion calculation balance made by the Torsion Balance Company.

In the warp preparation department there has been installed by the Saco-Lowell Shops one of its spoolers, and a slasher for preparing cotton warps; also a high speed warper, by T. C. Entwistle Company. The Whitin Machine Company has supplied a 180-spindle, long chain quiller, and the Johnson & Bassett Company, a quiller of its make. The Universal Winding Company has supplied a winder for cop and bobbin winding and an 8 spindle doubler, also a winder for the high speed warper.

The woolen and worsted warp preparation department contains two 40-end jack spoolers, two spool racks for 12 spools each, one pattern dry frame dresser, one pipe and cylinder dresser, one 60-inch reel, one 82-inch reel, and one double head beamer, all supplied by the Davis & Furber Machine Company.

The Weaving Department contains four looms supplied by the Draper Corporation, which include a plain Northrup, an 8-harness corduroy, an improved Northrup, a Northrup with dobby. The Stafford Loom Company has installed

one plain, one cam, one dobby loom and one broad sheeting loom, all equipped with individual motors; the Whitin Machine Works, a side cam twill, a plain print cloth loom, equipped with Kip-Armstrong electric warp stop motion; Crompton & Knowles Loom Works a jean loom and a plain loom with individual drive. Four of these looms are equipped with Abbott cleavers made by the Abbott Wire and Cast Steel Warp Cleaving Company. The Hopedale Manufacturing Company installed one of its high speed looms with individual motor.

The fancy loom section includes a Stafford Ideal 16-harness automatic shuttle-changing loom, a Whitin 20-harness dobby loom, and the following furnished by the Crompton & Knowles Loom Works: Knowles gingham 4 by 1 boxes, Crompton gingham 4 by 1 boxes, one Crompton towel 2 by 1 boxes, two Terry towel and one huck towel looms, a 20-harness dobby 4 by 1 boxes, fancy leno loom, and a Crompton fancy cotton single cylinder 20-harness dobby.

The woolen and worsted section contains a Knowles 20-harness Gem, a Crompton 24-harness worsted 4 by 4 boxes, a Crompton 6 by 1 double cylinder 20-harness dobby, one heavy 20-harness 4 by 4 boxes, one 20-harness and one 25-harness blanket, seven intermediate woolen 25-harness 4 by 4 boxes and two 90-inch 25-harness heavy woolen looms.

The Jacquard loom section includes one Stafford silk loom, 1,200-hook, Halton head; one 400-hook, single-lift Schaum & Uhlinger Jacquard, mounted for 4-bank, narrow fabric loom; one Skinner Brussels carpet loom, three-quarters wide, equipped with 1,280-hook Jacquard head presented by the Bigelow-Hartford Carpet Company. The Crompton & Knowles Loom Works has furnished one Knowles fancy loom, single-lift Jacquard; one Knowles fancy loom, double-lift Jacquard; one Knowles fancy loom, Jacquard tied up for leno, one Knowles loom, 4 by 4 boxes, 54-inch, with 600-hook, double-lift, double-cylinder McMurdo Jacquard head, tied up for damask napkin designs; one Crompton & Knowles 72-inch tapestry loom, with 2,600-hook Halton Jacquard head, one 840-hook, double-lift, single-cylinder Jacquard on Crompton & Knowles 4-bank ribbon loom, one 800-hook, double-lift Knowles Gem silk brocade Jacquard machine, 4 by 4 boxes.

The silk loom section includes one Stafford silk loom, 20-harness dobby, 2 by 1 box motion, sliding bar warp stop motion, filling feeler, extended beam stands, motor drive; one Crompton & Knowles silk loom, 4 by 4 box motion, 20-harness head motion, individual motor drive.

For the purpose of card cutting there has been furnished one Jacquard fine index card-cutting machine by John Royle & Sons; one Jacquard French index card-cutting machine by the same concern.

Chemistry and Dyeing Department.—The Chemistry Laboratory consists of one to give instruction in General Chemistry and Qualitative Analysis and provides facilities to take 120 students. The Quantitative Laboratory takes care of some 50 students and contains the necessary drying closet, steam bath, electrolytic table. The Balance Room has eleven analytical balances made by such concerns as Christian Becker, Eimer & Amend, and H. L. Becker's Sons & Company. The Organic Laboratory has facilities to take care of approximately 25 students having the necessary equipment required in the preparation of basic organic compounds and instruments used in the manufacture of dyes such as autoclaves, electric and gas combustion furnaces.

The Engineering Chemistry Laboratory contains the following equipment: a Becker chainomatic Westphal balance, a Stormer viscosimeter, a Doolittle viscosimeter, an Engler viscosimeter, Saybolt viscosimeters, Pensky-Martin flash tester, Cleveland open cup flash tester, Mahler oxygen bomb calorimeter, Emerson oxygen bomb calorimeters, Parr peroxide bomb calorimeter, Parr sulphur bomb, New York State closed testers, carbon residue apparatus, Orsat flue gas apparatus, Hempel gas analysis apparatus, and the usual chemical apparatus and analytical balances.

The Chemical Textile Testing Laboratory contains the following: a Scott serigraph strength tester, a Scott single strand strength tester, a Freas drying oven and Becker analytical balance for moisture determinations, a mercury arc lamp for ultra violet, a fadeometer, a launderometer, yarn reels, a twist counter, an extraction apparatus, a centrifuge, a Scott regain indicator, a barometer, a Hygrodeik

hygrometer, Sling psychrometers, a DuNuoy tensiometer, a Zeiss dipping refractometer, an Abbé fractometer, a Gaertner spectroscope, a polariscope, a MacBeth color matching lamp, a Mackay cloth oil tester, a Duboscq colorimeter, a Lovibond tintometer, and the usual chemical apparatus and analytical balances.

The Microscopy Laboratory has been equipped with the following: a polarizing chemical microscope, twelve ordinary microscopes, a Minot rotary microtome, a Spencer table microtome, a Zeiss comparison ocular, Chalet lamps, individual lamps, Silvermann illuminators, mechanical stages, dark ground illuminators, a vertical illuminator, a camera lucida, polarizing equipment, an arc lamp, stools, microscope tables, and the usual auxiliaries.

The Photography and Photomicroscopy Laboratory equipment is as follows: Bausch and Lomb horizontal photomicrographic apparatus, Leitz vertical photomicrographic apparatus, Lucas vertical photomicrographic apparatus, Wratten filters, Klieg lamps, dark-room lamps, a projection printer, a graphic camera with focal plane shutter; also much small apparatus such as tanks, trays, washers, etc.

The Chemical Museum has been provided with cases and representative dyestuffs all furnished by various dyestuff manufacturers of this country and abroad. This offers an unparalleled opportunity for students to study and experiment with almost all of the representative dyes which are used in the textile industry.

The Experimental Dyeing Laboratory is equipped with fifty-six steam heated dyeing baths and individual benches, reels and balances. There is also an ageing chamber and a Philadelphia Drying Machinery Company's Hurricane Dryer besides a large collection of dyestuffs.

The Experimental Printing Laboratory is equipped with a power-driven, full-sized, two-roll calico printing machine, and a smaller one-roll, power-driven printing machine, both made by Rice, Barton & Fales, and a small hand-driven, laboratory printing machine, an iron-jacketed steaming chamber, and a set of steam-jacketed copper kettles.

To give instruction in dyeing on a basis which is more comparable with commercial practice there is provided a laboratory which includes the following equipment: a small kier, fitted with E. D. Jefferson's circulating device, a Permutit filter; a mercerizing machine, raw stock and yarn dyeing machines, Klauder-Weldon Dyeing Machine Company; a jig dyeing machine; a set of drying cans; a chain dyeing machine; a raw stock drying table; a padding mangle; a hydro-extractor; a Psarski experimental dyeing machine, a Hussong experimental dyeing machine, equipped for raw stock or yarns, a Rodney Hunt sample piece dyeing machine, equipped with an automatic temperature and pressure-regulating apparatus, made by C. J. Tagliabue Manufacturing Company. The Franklin Process Company has furnished a 25-pound bronze dyeing machine.

Finishing Department.—The Woolen and Worsted section includes a motor-driven Clipper cloth 4-string washer, a fulling mill, and a combination fulling and washing mill for jersey fabrics, furnished by the Rodney Hunt Company; a sample fulling mill, a kicker mill, furnished by James Hunter & Company; an up and down dry gig, a rolling and stretching machine, an up and down wet gig, a steam finishing machine, a 60-inch, 3-burner singeing machine, adapted for cotton, silk or worsted goods, a 2-cylinder double-acting brushing machine. Curtis & Marble Machine Company has furnished a 60-inch 4-cylinder sanding and polishing machine; a mantle steaming and air cooling machine, equipped with a direct connected motor and a Nash pump; and a 66½-inch motor driven, single woolen shear, equipped with list saving motion; a 6-4 double shear, an A. W. C. measuring and weighing machine, furnished by Parks & Woolson; a dewing machine, a 6-4 Voelker rotary press, furnished by G. W. Voelker & Co.; a tentering and drying machine furnished by John Heathcote; a single crabbing machine, H. W. Butterworth & Son; a 72-inch woolen napper donated by Davis & Furber; a 32-inch basket hydro-extractor, W. H. Tolhurst; a Lintz & Eckhardt cloth numbering machine, from Durbrow & Hearne Company; a steam press for underwear, United States Hoffman Company; a sewing machine, Birch Brothers; a trimming and overseaming machine, The Merrow Machine Company.

The Cotton section includes a 40-inch inspecting and brushing machine, a 44-inch No. 25 railway sewing and rolling machine, a 44-inch cotton shearing machine,

Type No. 34, a 44-inch No. 3 steam calender rolling machine, a 40-inch cloth folder, a 40-inch winder and measurer, a set of 44-inch shear blades for grinding purposes, furnished by Curtis & Marble Machine Company; a 48-inch No. 4 opening, sewing and rolling machine, a No. 1 hand power portable railway sewing machine, furnished by Dinsmore Manufacturing Company; a 40-inch 4-tank open soaping machine equipped with patent flushing rolls, brass and rubber squeeze rolls and spiral openers, furnished by Birch Brothers; an 84-inch 36-roll, ball bearing, double acting napper, equipped with a 7½-horsepower General Electric motor drive, furnished by Davis & Furber (the ball bearings were donated by the Fafnir Bearing Company); a 40-inch, 3-roll water mangle, with husk and brass rolls and usual attachments and equipped with a 48-inch Mycock scutcher, and a 40-inch Mycock cloth expander made by Thomas Leyland & Company; a 40-inch, 2-roll starch mangle, a 40-inch upright drying machine with 10 copper cylinders equipped with Files dry can system; a 40-inch sprinkler, a 40-inch, 5-roll Universal calender with chasing attachment and equipped with a 40-inch Mycock cloth expander, a pasting table with plate, furnished by the Textile-Finishing Machinery Company; a 16 by 24 inch bronze-covered stretcher for the drying cans, C. A. Luther & Company; a 40-inch double bristle stretcher for drying cans, American Finishing Machinery Company; a trimming and overseaming machine, The Merrow Machine Company; a 40-inch Tommy Dodd starch mangle, and a 44-inch, 50-foot vibratory tentering machine, H. W. Butterworth & Sons Company. This machine is directly driven by a 7½-horsepower variable speed motor and is equipped with a Schwartz automatic electric guider, made by L. H. A. Schwartz & Company.

Engineering Department.—The Steam Engineering Laboratory contains the following equipment arranged for experimental purposes: A 50-horsepower Allis-Chalmers Corliss steam engine direct connected to an Alden absorption dynamometer, and piped to exhaust its steam to the atmosphere, to a Wheeler surface condenser or to the Kerr turbine; a Kerr seven-stage turbine driving directly a 25-kilowatt Richmond Electric Company's alternating current generator and piped to exhaust either to the atmosphere or the condenser. It may be operated either as high pressure or low pressure turbine, and the generator has special connections to illustrate various commercial phases. In addition there are a 4 by 6 Deane triplex power pump, two 2-inch centrifugal pumps made by Lawrence Machine Company, Lawrence, Mass., a Clayton air compressor and necessary tanks, scales and measuring instruments.

The Electrical Engineering Laboratory consists of two sections, one of which is devoted to instruction in the generation and transmission of power, and contains the necessary switchboard and instruments to control a 25-kilowatt alternating current turbo generator and a 15-kilowatt motor generator set arranged to supply either direct or alternating current. In addition there are a 24-horsepower direct current Allis-Chalmers motor and a 10-horsepower direct current General Electric motor, also a 10 and a 7.5 horsepower General Electric alternating current motor besides a General Electric 3-kilowatt rotary transformer and three Westinghouse stationary transformers. The other section is the instrument laboratory and is for the purpose of giving instruction in the measurement of current, voltage, resistance, and in the calibration of instruments. It is supplied with standard alternating and direct current measuring instruments of a wide range of sizes and capacities. A 160 ampere hour storage battery offers a source of constant voltage. A standard Leeds & Northrup photometer with Lummer-Brodhun screen and Macbeth illuminometer provide means of illumination measurements.

Machine Shop.—The equipment of the machine shop is as follows: Four standard engine lathes, 13-inch swing, 6-foot bed, and an engine lathe, 18-inch swing, 10 foot bed; three standard engine lathes, 14-inch swing, 6-foot bed, from Flather & Company; a standard engine lathe, 15-inch swing, 6-foot bed, from F. E. Reed Company; an engine lathe, 18-inch swing, 6 foot bed from Champion Tool Works; a standard engine lathe, 15-inch swing, 6-foot bed, from S. H. Putnam Sons; one No. 1 Universal milling machine, with all three feeds automatic, from Kempsmith Manufacturing Company; one 24 by 24 inch, 6-foot planer, from the Mark Flather Planer Company; one 23-inch upright drill, with back gears and power feed, from J. E. Snyder & Son; one 14-inch single sensitive drill, from the

Stanley Manufacturing Company; one No. 1 Universal grinder, from Landis Tool Company; five speed lathes, 17-inch swing, 5-foot bed, one 20-inch wet tool grinder, and one 12-inch, 2-wheel dry grinder, from J. G. Blount; an American twist drill grinder, from the Heald Machine Company; one Type 1B portable electric grinder from the Cincinnati Electric Tool Company; one 30-inch grindstone and frame, from the Athol Machine Company; a single spindle centering machine, from D. E. Whiton Machine Company; one 15-inch shaper, from Potter & Johnson; one power hacksaw, from the Fairbanks Company; one cold saw, from John T. Burr & Son; one Eureka metal power saw, Manning, Maxwell & Moore; one Type CC electric drill, Cincinnati Electric Tool Company; one Universal milling attachment for Kempsmith milling machine, and one Hisey Type B ½-horsepower tool post grinder, Taylor Machinery Company; one No. 2 Cory bench straightener, Manning, Maxwell & Moore; one No. 3 Universal cutter and reamer grinding machine, Browne & Sharpe; a well-equipped tool room containing a selected stock of the best makes of small tools, such as drills, taps and dies, milling cutters, reamers, gauges, micrometers, etc.

PRIZES AWARDED IN JUNE, 1940

The National Association of Cotton Manufacturers offers a medal to that member of the graduating class who maintains the highest standing throughout his course in Textile Engineering (General or Cotton Option) or the course in Cotton Manufacture. To *John A. Goodwin.*

The Proprietors of the Locks and Canals on the Merrimack River Scholarship at Massachusetts Institute of Technology. Several years ago the Proprietors of the Locks and Canals on the Merrimack River, a corporation owning the power rights on the Merrimack River in Lowell, gave to the Massachusetts Institute of Technology a sum of money to provide graduate scholarships to graduates from the Lowell Textile Institute who held a degree and were recommended by the trustees. Applicants must have maintained throughout their undergraduate courses a high scholastic record and must meet the requirements of the Graduate School of the Massachusetts Institute of Technology. To *Merlen C. Bullock.*

Louis A. Olney Book Prizes.—Prizes in the form of books are awarded each year to the successful candidate on graduation day. The conditions in detail are as follows:—

$10 to the student graduating from the Chemistry and Textile Coloring course, who, not having already received recognition by appointment as an assistant instructor, shall have maintained the highest scholarship through the course. To *Arthur S. Davis.* Honorable Mention: *Arthur W. Lanner.*

$10 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his second year. To *George J. Mandiksos.*

$5 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship during his second year. To *Irving P. Wolf.* Honorable Mention: *Arthur J. Moreau.*

$10 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry. To *Richard E. Petersen.*

$5 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the second highest scholarship in first-year Chemistry. To *Peter DeMaillie.* Honorable Mention: *William J. Sidebottom.*

STUDENT ACTIVITIES AND ORGANIZATIONS

School Publications.—The Text is issued bi-weekly and it contains news pertaining to activities in the Institute as well as information concerning alumni. The Pickout is an annual publication in charge of a manager and editor selected from the senior class. The board is composed of representatives from the various classes.

Fraternities.—There are four fraternities, three of which are national and one is local. They afford opportunity for social life desired in a college career.

Dramatic Club.—The Dramatic Club gives a theatrical program annually Appropriation is made from the profits to the treasury of the Athletic Association.

Professional Clubs.—The Textile Engineering Society is composed of all students registered in the Textile Engineering Course. The society holds meetings at which speakers are heard. The Student Chapter of the American Association of Textile Chemists and Colorists sponsors meetings addressed by speakers on technical subjects.

Rifle Club.—The rifle club offers opportunity to all students to attain proficiency in marksmanship and selects the team for interscholastic matches with other colleges.

Honor Society.—To degree candidates who have maintained a high scholarship for three years' work, or who have met with certain similar requirements, is accorded the honor of membership in the society Tau Epsilon Sigma. Relatively a membership in this society corresponds to that in some of the well-known honor societies of the liberal arts and scientific colleges. It requires constant attendance and application to the work of the course for any student to reach the scholarship level entitling him to this membership.

Honor Roll.—The President's List includes upper classmen taking a regular course who have a general average of eighty percent and no deficiencies.

Student Book Store. —A book store is operated on the cooperative plan by the Lowell Textile Associates, Inc., for the benefit and convenience of students who desire to purchase books, supplies, and other materials for use in connection with their work. It is conducted by a manager and two clerks, all of whom are undergraduates. The general business policy is under the control and supervision of a member of the Faculty. Any student may become an associate member of the Lowell Textile Associates, Inc., upon payment of the required fee and is thereby entitled to discount privileges when purehasing from the Book Store and from certain firms in the city of Lowell.

Alumni Association.—The Alumni Association of the Institute holds its annual meeting and banquet in May of each year.

The membership of the association is composed of graduates of the day courses and is open to any non-graduate who has attended the Institute for at least one year.

Officers for the Year 1940–41

Harold V. Farnsworth, '16, *President*
James A. Irvine, '17, *Vice-President*
A. Edwin Wells, '20, *Secretary-Treasurer*

Communications should be addressed to A. Edwin Wells, Lowell Textile Institute.

Executive Committee

Roy H. Bradford, '06
James F. Dewey, '04
Parker F. Dunlap, '34
Charles H. Forsaith, '20
Edwin D. Fowle, '24
Olin D. Gay, '08
Milton Hindle, '25
Robert F. Jessen, '36
Thomas Joy, '26
Francis P. Madden, '13
Kilburn G. Pease, '38
Richard W. Rawlinson, '31
Everett B. Rich, '11
Homer C. Riggs, '17
J. Milton Washburn, Jr., '21

GRADUATES OF 1940

Department of Chemistry and Textile Coloring

Master of Science in Textile Chemistry

Bolek Louis Lizak
B.S., Lewis Institute, 1937

Nicholas John Valvanis
B.S., Massachusetts State College, 1939

Bachelor of Textile Chemistry

William Boyd, Jr.
Andrew Morris Campbell
*Vernon Warren Colby
*Arthur Sabin Davis
John Schofield Gill
Richard Thomas Hall
*Arthur William Lanner
Edward Mark Lynch, Jr.
*Edward John Felix Maslanka
William Arthur Nelson
*Andrew Frederick Nuttall
Newell Baird Ritchie
*Safford Pershing Sweatt
*Malcolm Russell Woodard

Department of Textile Engineering

Master of Science in Textile Engineering

Russell Lee Brown
B.T.E., Lowell Textile Institute, 1921

*James Harrington Kennedy, Jr.
B.T.E., Lowell Textile Institute, 1936

*John Charles Lowe
B.T.E., Lowell Textile Institute, 1934

Lawrence Smith
B.S., United States Naval Academy, 1932

Bronislaw John Swiatek
B.S., Tri-State College, 1938

Bachelor of Textile Engineering

Lawrence Aigen
Kenneth Charles Beltramini
*Merlen Clarke Bullock
*Stanley Falk
James Mayer Feuerstein
*Louise Fox
*Theodore Webster Fox
Robert Clarke Fyfe
*John Alden Goodwin
*Robert Barney Hull
James Vincent Kiernan
*John Seede McGilly
Joseph Paul Pelt, Jr.
*Paul Roth
Joseph Melvin Silverman
*Walter Stephen Thayer
*Henry Edward Thomas

Diploma in Cotton Manufacture

Clive Edward Hockmeyer, Jr.
Richard Holmes Rees
Eduardo Mejia
B.S., Tufts College

Diploma in Wool Manufacture

Chauncey Jacob Mackle
Gamaliel Mardiros Yacubian

Diploma in Textile Design

Edward Shackford Hobson

**Member of Tau Epsilon Sigma, Scholastic Honor Society.*

REGISTER OF DAY STUDENTS

Graduate Students

Home Address	*Lowell Address*
Buck, Roy Garvin, VI, Oakland, Calif. B.S., U. S. Naval Academy, 1933	———
Cooper, Harlan Cyril, VI, Indianapolis, Ind. B.S., U. S. Naval Academy, 1931	713 East Merrimack Street
Jones, Charles Andrews, Jr., VI, Port Royal, Va. M.S., University of Wisconsin, 1927 B.S., Virginia Military Institute, 1919	———
Qualey, Francis Joseph, IV, Lowell, Mass.	126 London Street
Twigg, Donald Whitman, VI, Reading, Mass. B.S., U. S. Naval Academy, 1933	———

Undergraduate Students
Candidates for Degrees

Class of 1941

Adie, Donald Miles, VI, Lowell, Mass.	26 Otis Street
Alexander, Gerard, VI, Kew Gardens, L. I., N. Y.	Omicron Pi House
Bardzik, Thaddeus, IV, Dracut, Mass.	———
Batcheller, Ben Pitman, VI, Andover, Mass.	———
Brown, Needham Ballou, Jr., VI, Andover, Mass.	———
Carmichael, Robert Dana, VI, Andover, Mass.	———
Condon, John Andrew, Jr., IV, North Billerica, Mass.	———
Dubrule, Louis Joseph, IV, Lawrence, Mass.	———
Epstein, Edward Joseph, IV, Newark, N. J.	Sigma Omega Psi House
Factor, Sidney Wilfred, IV, Haverhill, Mass.	———
Finard, Saunder, IV, Revere, Mass.	———
Gari, Jose Via, VI, Mexico City, Mexico	11 White Street
Gass, Matthew, IV, Lowell, Mass.	201 Hildreth Street
Gatzimos, Aristophanes Demetrius, IV, Lowell, Mass.	172 Adams Street
Greenbaum, Bernard Saul, IV, Haverhill, Mass.	———
Grondin, Abraham Hector, IV, Lowell, Mass.	111 Alma Street
Guilfoyle. Donald William, VI, Providence, R. I.	337 Beacon Street
Hamilton, Arthur Theodore, IV, Lowell, Mass.	337 Beacon Street
Haas, Alexander Robert, VI, Lowell, Mass.	43 Plymouth Street
Higginbottom, George Stephen, IV, Lowell, Mass.	46 Otis Street
Inkpen, Norman Alfred, IV, Ward Hill, Mass.	———
James, Ernest Peter, IV, Haverhill, Mass.	———
Jay, Joshua Daniel, VI, Brooklyn, N. Y.	218 Wilder Street
Kahn, Seymour James, IV, Lowell, Mass.	116 Princeton Boulevard
Kaplan, Ralph Reuben, VI, Lowell, Mass.	43 Hawthorne Street
Koulas, Stanley Charles, IV, Chelmsford, Mass.	———
Landfield, Harold, IV, Dorchester, Mass.	445 High Street
Lane, Joseph James, 2nd, VI, Millbury, Mass.	337 Beacon Street
Lewis, Dorothy Elaine, VI, Chelmsford, Mass.	———
Linden, Leo, VI, Chelsea, Mass.	———
McTeague, George David, IV, Lowell, Mass.	298 Riverside Street
Mahoney, Francis Vincent, Jr., IV, North Billerica, Mass.	———
Manning, Neil Joseph, IV, Lowell, Mass.	118 Mt. Washington Street
Mason, Frederick Rufus, VI, Lowell, Mass.	9 White Street
Milberg, Maurice, VI, Lowell, Mass.	75 Fourth Avenue
Mintz, Irving Paul, IV, Passaic, N. J.	148 Riverside Street
Murphy, Francis Arthur, IV, Brookline, Mass.	———

Home Address	*Lowell Address*
Okun, Seymour, VI, Lowell, Mass.	337 Beacon Street
Pernick, David, VI, Maspeth, L. I., N. Y.	218 Wilder Street
Pero, Henry Leland, VI, West Willington, Conn.	Omicron Pi House
Phillips, Maurice Gordon, VI, Southbridge, Mass.	337 Beacon Street
Platt, Walter Wallace, IV, Lawrence, Mass.	———
Portilla, Jose Luis, VI, Mexico, D. F., Mexico	11 White Street
Puliafico, Salvatore Joseph, IV, Barre Plains, Mass.	59 Crescent Street
Rashkin, Bernard, VI, Lowell, Mass.	19 Mt. Hope Street
Rich, Charlotte Merline, IV, Haverhill, Mass.	———
Roberts, Angus Henry, IV, Lowell, Mass.	35 Wiggin Street
Saltsman, Sidney Irving, IV, Lowell, Mass.	89 Washington Street
Scarmeas, Harry George, IV, Lowell, Mass.	21 Hancock Avenue
Schiffer, Lathrope Adolph, VI, New York, N. Y.	66 Riverside Street
Sinski, Henry Anthony, VI, Gardner, Mass.	121 Pleasant Street
Skalkeas, Basil George, IV, Lowell, Mass.	53 Avon Street
Sullivan, Paul John, IV, Lowell, Mass.	33 South Walker Street
Szymosek, Frank John, IV, North Andover, Mass.	———
Tartikoff, Jordan Alvin, VI, Brooklyn, N. Y.	218 Wilder Street
Turner, George Robert, IV, Lowell, Mass.	Phi Psi House
Urlaub, George Samuel, IV, Bellaire, L. I., N. Y.	298 Riverside Street
Webb, Ralph Peabody, VI, Dracut, Mass.	———
Weil, Clarence Bernard, IV, New York, N. Y.	148 Riverside Street
Wolf, Irving Jacob, VI, Lowell, Mass.	5 White Street
Woodard, Alice Marjorie. VI, Chelmsford, Mass.	———
Zellweger, Ralph John, VI, Palisade, N. J.	Phi Psi House

Class of 1942

Allard, Ernest Herbert, IV, Lowell, Mass.	78 Hanks Street
Angell, Charles Francis, Jr., IV, Chestnut Hill, Mass.	137 Riverside Street
Armstrong, George Gordon, Jr., VI, Littleton, Mass.	———
Baer, Leonard Herman, VI, Brooklyn, N. Y.	Sigma Omega Psi House
Boule, Raymond George, IV, Lowell, Mass.	66 Mt. Hope Street
Brook, John Frederick, VI, Simcoe, Ont.	125 Mt. Washington Street
Bulson, Douglas Whitney, VI, Lowell, Mass.	43 Plymouth Street
Caine, Philip Daniel, IV, Lowell, Mass.	89 Puffer Street
Coffin, William Burton, IV, Melrose, Mass.	———
Corcoran, Leonard Robert, IV, Bradford, Mass.	———
Cordeau, Georges Edward, IV, Lowell, Mass.	1014 Lakeview Avenue
Cryan, Thomas Francis, VI, Lowell, Mass.	59 Temple Street
Eichner, Albert David, VI, New York, N. Y.	103 School Street
Hamer, David Orville, Jr., IV, Dracut, Mass.	———
Harper, Cyril Newcomb, IV, Wakefield, Mass.	———
Hornung, Sanford Lee, IV, Corning, N. Y.	137 Riverside Street
Hunter, Robert Arnold, VI, Newbury, Mass.	Omicron Pi House
Kent, George, VI, Great Neck, L. I., N. Y.	123 Riverside Street
Leary, Gordon Simpson, IV, Lowell, Mass.	834 Andover Street
Lisien, Walter, IV, Lowell, Mass.	85 Whipple Street
McCartney, Robert Wallace, IV, Lowell, Mass.	16 Sidney Street
McMahon, Joseph Justin, IV, Lowell, Mass.	7 Belmont Street
Mandikos, George John, IV, Haverhill, Mass.	———
Moreau, Arthur Joseph, IV, Lowell, Mass.	45 West Street
Murphy, John Anthony, IV, Lowell, Mass.	123 Andrews Street
Noonan, Paul Francis, IV, Lowell, Mass.	45 By Street
Oppenheim, Morton Lewis, VI, Lawrence, Mass.	———

Home Address	*Lowell Address*
Pappas, Vasil James, IV, Dracut, Mass.	————
Pinatel, John Andre, VI, Paterson, N. J.	137 Riverside Street
Pratt, Caroline Elizabeth, IV, Lowell, Mass.	119 Fairmount Street
Rawlinson, Dustin, IV, Hampstead, N. H.	53 Mt. Hope Street
Roberts, Russell Frederick, VI, Tyngsboro, Mass.	————
Rogoff, David, VI, Mattapan, Mass.	Sigma Omega Psi House
Roumas, Zenon Anthony, IV, Peabody, Mass.	53 Mt. Hope Street
Sandner, Charles Rodney, IV, Lawrence, Mass.	————
Sanford, George Morse, Jr., VI, Malden, Mass.	————
Schiffer, Clifford Elais, IV, New York, N. Y.	298 Riverside Street
Schiller, William, VI, Brookline, Mass.	5 White Street
Shafter, Stuart Frederic, IV, Lowell, Mass.	373 Beacon Street
Shapiro, Jeffrey Joseph, VI, Brooklyn, N. Y.	148 Riverside Street
Smith, Francis Dunham, VI, Dover-Foxcroft, Me.	137 Riverside Street
Staklinski, Walter Albert, VI, Rockville, Conn.	32 Colonial Avenue
Szopa, Stanley, IV, Lowell, Mass.	39 Beacon Street
Thomas, Donald Henry, IV, Medford, Mass.	————
Wolf, Irving Paul, IV, Brooklyn, N. Y.	Sigma Omega Psi House

Class of 1943

Allard, Claude Henry, IV, Lowell, Mass.	78 Hanks Street
Allen, Craig, VI, Scarsdale, N. Y.	142 Riverside Street
Barry, Gerard George, IV, Lowell, Mass.	539 Chelmsford Street
Beuter, Ralph Julius, VI, Richmond Hill, N. Y.	Omicron Pi House
Bevington, Lawrence Elliott, VI, Lawrence, Mass.	————
Bisko, Stephen John, VI, Webster, Mass.	14 Mt. Washington Street
Bloom, Joseph, VI, Brookline, Mass.	Y. M. C. A.
Brown, Chandler Russell, IV, Marblehead, Mass.	Omicron Pi House
Bullock, Ralph Louis, IV, Lexington, Mass.	————
Colburn, John Allen, IV, Dracut, Mass.	————
Cotton, John Page, Jr., VI, Brookline, Mass.	63 Varnum Avenue
Coulman, Malcolm Prescott, IV, Saugus, Mass.	————
Davis, Esther Alice, IV, Lowell, Mass.	252 Middlesex Street
de Basterrechea, Juan, IV, Habana, Cuba	9 White Street
DeKalb, John Ernest, IV, Chelmsford, Mass.	————
DeMallie, Peter, IV, Lowell, Mass.	275 Gibson Street
Donnelly, Eliot Manning, VI, Amsterdam, N. Y.	43 Plymouth Street
Foisy, Robert William, VI, Lowell, Mass.	55 Florence Road
Foster, Clarence Everett, VI, Dracut, Mass.	————
Fox, Barbara Elisabeth, IV, Dracut, Mass.	————
Fuller, Samuel Lloyd, VI, Lowell, Mass.	R-2, Box 99
Garnett, Richard Herbert, VI, Edgewood, R. I.	32 Colonial Avenue
Gillick, Thomas John, Jr., IV, Lowell, Mass.	47 South Walker Street
Glen, Cornelius Leonard, Jr., VI, North Tewksbury, Mass.	————
Goldberg, Herbert Arthur, VI, Dorchester, Mass.	Sigma Omega Psi House
Gross, Stanley Frederick, VI, Woodmere, N. Y.	63 Varnum Avenue
Griffin, Roger Castle, Jr., IV, Needham, Mass.	337 Beacon Street
Hagerty, Francis William, VI, Lexington, Mass.	————
Haggerty, William Thomas, IV, Lowell, Mass.	28 Windsor Street
Harrison, Maurice William, VI, Lowell, Mass.	18 Bellevue Street
Hochschild, Reiner George, IV, Shelton, Conn.	123 Riverside Street
Hollingworth, Clifford Earl, IV, Dracut, Mass.	————
Howard, Philip John, IV, North Andover, Mass.	————
Johnson, John Thomas, IV, Lowell, Mass.	35 Barasford Avenue
Keirstead, Edith Louise, VI, Lowell, Mass.	34 Chauncey Avenue
Keizer, Miriam Eleen, IV, Westford, Mass.	————

Home Address	*Lowell Address*
Kelly, Allan William, VI, Lowell, Mass.	41 E Street
Kennedy, Matthew Anthony, VI, Lowell, Mass.	19 Dracut Street
Kittay, Morton Victor, VI, New York, N. Y.	Sigma Omega Psi House
Korb, Roland Carl, VI, Methuen, Mass.	———
Krintzman, Edward, VI, Worcester, Mass.	Sigma Omega Psi House
Lau, Ching Sut, VI, New York, N. Y.	226 Riverside Street
Liang, Leland Sung, VI, Hong Kong, China	32 Colonial Avenue
McLean, James Arthur, VI, Lowell, Mass.	30 Greenfield Street
McMahon, Stillman Dillon, IV, Lowell, Mass.	7 Belmont Street
McNellis, James Stanislaus, IV, Lowell	74 Foster Street
Magat, Eugene, IV, New York, N. Y.	32 Colonial Avenue
Mallon, John Francis, IV, Lawrence, Mass.	———
Messer, Albert Sidney, IV, Ozone Park, N. Y.	63 Queen Street
Miller, Alex Michael, VI, Perth Amboy, N. J.	92 Gates Street
Morel, Gerard Charles, IV, Lawrence, Mass.	———
Morton, Jackson Wentworth, IV, Egypt, Mass.	43 Plymouth Street
Murray, Martin Patrick, IV, Lowell, Mass.	30 Cosgrove Street
Newell, William Andrews, VI, Holyoke, Mass.	53 Mt. Hope Street
O'Leary, Louise Margaret, IV, Dracut, Mass.	———
Petersen, Richard Edward, IV, Concord, Mass.	———
Petricek, Bruno, VI, Clifton, N. J.	137 Riverside Street
Pettengill, Warren Martin, VI, Lowell, Mass.	148 Riverside Street
Queeney, John Hart, VI, Scituate, Mass.	75 Fourth Avenue
Quinn, Thomas Gregory, Jr., IV, Lowell, Mass.	3 Rhodora Street
Roberts, Donald Chester, VI, Tyngsboro, Mass.	———
Rowen, Edward Joseph, VI, West Roxbury, Mass.	62 Sterling Street
Ryan, Joseph Michael, IV, Amesbury, Mass.	———
Sayers, John Timothy, Jr., IV, Lowell, Mass.	236 Princeton Boulevard
Schlesinger, Morton, IV, New York, N. Y.	Sigma Omega Psi House
Schwartzman, Moses, IV, Mexico City, Mexico	63 Crawford Street
Sidebottom, William James, IV, Milton, Mass.	Phi Psi House
Siegel, Harold, VI, Brooklyn, N. Y.	75 Fourth Avenue
Silberstein, Robert Herbert, VI, New York, N. Y.	43 Plymouth Street
Simon, Richard Bernard, IV, New York, N. Y.	Sigma Omega Psi House
Spanos, George Peter, IV, Lowell, Mass.	14 West Bowers Street
Sullivan, Paul Henry, IV, Haverhill, Mass.	———
Taylor, William Warren, VI, Chelmsford, Mass.	———
Teichner, Arthur Charles, IV, Chicago, Ill.	Sigma Omega Psi House
Tyrie, Wallace Rolley, IV, Haverhill, Mass.	———
Valente, Louie Joseph, VI, South Barre, Mass.	87 Linden Street
Wall, James Thomas, IV, Lowell, Mass.	157 Pleasant Street
Webster, Frederick Leonard, IV, Lowell, Mass.	167 D Street
Wielicka, Edward Dominic, IV, Lawrence, Mass.	———
Winer, Allen, IV, Medford, Mass.	———
Zenorini, Henry John, VI, Teaneck, N. J.	Phi Psi House
Zenorini, Joseph Aedan, VI, Union City, N. J.	32 Mt. Washington Street

Class of 1944

Abrahams, Alan Bernard, VI, Pittsfield, Mass.	37 Varney Street
Alperin, George, IV, Bradford, Mass.	———
Avramov, Rudi Marco, VI, Sofia, Bulgaria	Y. M. C. A.
Baril, Wilfrid Dolphis, IV, Lawrence	———
Barton, Douglas Robert, VI, Stow, Mass.	———
Beckowitz, Joseph Howard, VI, Yonkers, N. Y.	Sigma Omega Psi House
Bell, Walter George, VI, Burlington, Ont.	53 Mt. Hope Street
Bent, Robert Mace, Jr., VI, Worcester, Mass.	———
Bonte, Andre Roger, VI, Woonsocket, R. I.	137 Riverside Street
Brassil, Robert Daniel, IV, Lowell, Mass.	404 Wentworth Avenue

Home Address	*Lowell Address*
Brilliant, Ira Francis, IV, Brooklyn, N. Y.	42 Riverside Street
Broderick, Thomas William, IV, Pittsfield, Mass.	37 Varney Street
Chambers, Edward Francis, IV, Webster, Mass.	337 Beacon Street
Cherenson, Alan Harold, VI, Lowell, Mass.	71 Canton Street
Clogston, Samuel Leighton, VI, Lowell, Mass.	152 Wentworth Avenue
Costello, Thomas David, Jr., IV, Woburn, Mass.	———
Coughlin, Arthur Robert, VI, Lowell, Mass.	17 Cambridge Place
Dean, Philip Lemist, IV, West Medford, Mass.	———
Deminie, William Frederick, IV, Amesbury, Mass.	———
Donohoe, William James, IV, Lowell, Mass.	46 Birch Street
Doo, Vee-Bing, VI, Shanghai, China	87 Mt. Washington Street
Echavarria, Alexander Mauricio, VI, Medellin, Colombia, S. A.	15 Douglas Road
Fahey, John James, IV, Salem, Mass.	———
Farren, Roger Patrick, IV, Medford, Mass.	———
Fine, Theodore, VI, Brookline, Mass.	43 Plymouth Street
Frappier, Earl Francis, IV, Dracut, Mass.	———
Ganezer, Max, IV, Waterbury, Conn.	Sigma Omega Psi House
Gershenson, Suna Gervitz, VI, Mexico City, Mexico	5 White Street
Godet, John Russell, IV, Lowell, Mass.	71 Agawam Street
Goldberg, Melvin David, IV, Brookline, Mass.	5 White Street
Goldstein, Leon, VI, Port Washington, N. Y.	Sigma Omega Psi House
Gottlieb, Edwin Meyer, IV, Brooklyn, N. Y.	Y. M. C. A.
Haggerty, Isabel Francis, VI, Lowell, Mass.	127 Fort Hill Avenue
Haller, Robert Walter, IV, Lawrence, Mass.	———
Hallett, John Lawrence, Jr., VI, Lowell, Mass.	98 Wannalancit Street
Healy, Grant Samuel, VI, Webster, Mass.	337 Beacon Street
Helfgott, Stanley Lee, VI, Brightwaters, N. Y.	298 Riverside Street
Hirn, John Edward, Jr., IV, East Hartford, Conn.	Y. M. C. A.
Hogan, Thomas Patrick, IV, Lowell, Mass.	25 A Street
Hughes, Robert Edward, IV, Pittsfield, Mass.	337 Beacon Street
Jay, Milton Jerry, IV, Brooklyn, N. Y.	19 Mt. Hope Street
Kaplan, Kalman, VI, Everett, Mass.	43 Plymouth Street
Kenin, Philip, IV, Brooklyn, N. Y.	5 White Street
Kopycinski, Joseph Valentine, IV, Lowell, Mass.	242 Branch Street
Kosowicz, Julien Frank, VI, Lowell, Mass.	15 Leverett Street
LaFrance, Henry Joseph, IV, Tyngsboro, Mass.	———
Langlais, George Oliver, IV, Lowell, Mass.	10 Robert Place
Lasar, Lionel, VI, Brooklyn, N. Y.	42 Riverside Street
Leitch, John Badger, VI, Andover, Mass.	———
Leshowitz, Harold, IV, Brooklyn, N. Y.	53 Mt. Hope Street
Macdonald, Barbara Turner, VI, Rumford, R. I.	92 Stevens Street
McKittrick, Vernon Russell, VI, Lowell, Mass.	19 Hawthorne Street
MacLean, Philip Eugene, IV, Swampscott, Mass.	Omicron Pi House
Magown, Robert Malcolm, IV, Medford, Mass.	———
Maguire, John Paul, VI, Lowell, Mass.	31 Prospect Street
Malcolm, Bruce Brundage, VI, Pittsfield, Mass.	337 Beacon Street
Marcus, Martin Bernard, VI, Mattapan, Mass.	268 Shaw Street
Marinopoulos, Charles, VI, Lowell, Mass.	234 Adams Street
Martin, Paul Joseph, IV, Lowell, Mass.	34 Sycamore Street
Masaschi, Joseph Bernard, IV, Jamaica Plain, Mass.	———
Massey, Albert Joseph, IV, Lowell, Mass.	12 Carolyn Street
Merrill, John Walcott, IV, Tewksbury, Mass.	———
Mitchell, Alvin Emery, IV, Warwick, R. I.	290 Beacon Street
Munro, Livingston, IV, Watertown, Mass.	———
Murphy, George Campbell, IV, Buffalo, N. Y.	Phi Psi House
Nath, Virginia Louise, VI, Lowell, Mass.	2020 Middlesex Street

Home Address	*Lowell Address*
NICKERSON, HOWARD LESLIE, JR., IV, Chelmsford, Mass.	———
NOYES, JOHN HOWARD, IV, Andover, Mass.	———
O'LOUGHLIN, HELEN MARY, IV, Lowell, Mass.	75 Harris Avenue
PAYELIAN, JOHN, VI, Lowell, Mass.	94 Maple Street
PINCUS, STUART, IV, Brooklyn, N. Y.	53 Mt. Hope Street
PROCTOR, RICHARD, IV, Lowell, Mass.	187 Hovey Street
PULIAFICO, CARMELO ROSARIO, IV, Barre Plains, Mass.	59 Crescent Street
QUINN, JOHN KIERON, IV, Lowell, Mass.	118 Wentworth Avenue
RABINOWITZ, IRVING MANNY, VI, New York, N. Y.	Y. M. C. A.
RICHARDSON, GEORGE FRANCIS, IV, Lowell, Mass.	7 Fairmount Street
RUDNICK, MAXWELL, VI, New Haven, Conn.	Sigma Omega Psi House
SANDNER, WALLACE, IV, Lawrence, Mass.	———
SASLOWSKY, SIDNEY, VI, Brooklyn, N. Y.	42 Riverside Street
SILK, JAMES FRANCIS, IV, Lowell, Mass.	67 Lamb Street
SMOLER, IRWIN CHARLES, VI, New York, N. Y.	Sigma Omega Psi House
SPOFFORD, RAY MILTON, VI, Haverhill, Mass.	———
STROMVALL, ERNEST MALCOLM, IV, Lowell, Mass.	19 Sheldon Street
TOWEY, FRANK HENRY, IV, Lawrence, Mass.	———
WEINSTEIN, SAMUEL, IV, Brooklyn, N. Y.	Sigma Omega Psi House
WOITKOSKI, STEPHEN ANTHONY, IV, Pittsfield, Mass.	37 Varney Street

DIPLOMA STUDENTS

Class of 1941

BLANCHARD, ARMAND EUGENE, III, Southbridge, Mass.	173 A Street
BLOCH, SEYMOUR SAMUEL, I, Brookline, Mass.	50 Standish Street
CALLAHAN, GEORGE PAUL, II, Medford, Mass.	———
CAMPBELL, JOHN DUNCAN, II, South Boston, Mass.	Omicron Pi House
DICK, RUDOLPH CARL, JR., I, Swampscott, Mass.	6 Pawtucket Apartments
FEAD, ROBERT WILLIAM, II, Port Huron, Mich.	Phi Psi House
GARNETT, STANLEY ARTHUR, II, Edgewood, R. I.	Omicron Pi House
JOHNSON, ROY THEODORE, III, Chelmsford, Mass.	———
KOROSKYS, MICHAEL JOSEPH, II, North Andover, Mass.	———
MACKTEZ, LESTER ALLEN, II, Woonsocket, R. I.	Sigma Omega Psi House
PATRICK, STEPHEN EDMUND, JR., I, Augusta, Me.	337 Beacon Street
TOMASURIA, JOSEPH CHARLES, II, Lawrence, Mass.	———

Class of 1942

BROOK, GEORGE HENRY, II, Simcoe, Ont.	Phi Psi House
CLARK, GEORGE CARLYLE, II, Methuen, Mass.	———
DOLGE, DAVID BIGELOW, II, Hazardville, Conn.	Omicron Pi House
HARRIS, CARL WEBSTER, II, Penacook, N. H.	32 Colonial Avenue
HASELTINE, ROBERT CLIFTON, II, Haverhill, Mass.	Omicron Pi House
HAYWARD, WILLIAM EDWIN, II, Dedham, Mass.	Pawtucket Apartments
McELHINNEY, DOUGLAS HAMILTON, II, Caldwell, N. J.	Omicron Pi House
MEANY, JOHN LAWLESS, II, Leominster, Mass.	142 Riverside Street
PESETZKY, HERBERT, III, Lowell, Mass.	24 Holden Street
RAND, WOODBURY HOLMES, II, Brookline, Mass.	———
ROBINSON, JOHN BAILEY, II, Oxford, Me.	50 Standish Street
WHITING, FRANK EDWARD, II, Andover, Mass.	———
WILKINSON, VERNON LEE, I, Southbridge, Mass.	30 Colonial Avenue

Home Address	Lowell Address

Class of 1943

Ellis, Robert Warren, II, North Billerica, Mass.	————
Fieldsend, Arthur Tull, II, Hudson, Mass.	28 Riverside Street
Frank, Arthur Joseph, II, Lowell, Mass.	72 Montview Avenue
Hambleton, Winston Porter, I, Nashua, N. H.	————
Klashman, Julian Bernard, III, Cambridge, Mass.	Y. M. C. A.
O'Donnell, Thomas Francis, Jr., III, Lowell, Mass.	71 Canton Street
Rauser, Erwin Frank, Jr., I, Milwaukee, Wis.	159 White Street
Rindge, Samuel Everett, II, Longmeadow, Mass.	Standish Street
Sarver, Gerald Delano, II, Lawrence, Mass.	————
Sharpe, Robert MacQueen, Jr., II, Woodstock, Vt.	32 Colonial Avenue
Stohn, William Thomas, III, Middleboro, Mass.	5 White Street
Weber, Alfred Julius, III, Clifton, N. J.	43 Plymouth Street

Specials

Addison, William George, III, Andover, Mass.	————
Biron, Joan Marguerite, IV, Lowell, Mass.	56 Fairlawn Street
Cole, Virginia, III, Watertown, Mass.	Y. W. C. A.
Coon, Maurice Putnam, IV, Wakefield, Mass.	————
Falcon, James, IV, Methuen, Mass.	————
Karpowich, Bennie, III, Methuen, Mass.	————
Lerer, Mitchell, IV, Lowell, Mass.	91 Gates Street
Lodge, John 2nd, II, Chestnut Hill, Mass.	Omicron Pi House
MacAusland, Douglas Ray, III, Lowell, Mass.	76 Hawthorne Street
Mooar, Clarence Warren, III, Andover, Mass.	————
Rockwell, Thomas Plunkett, II, North Andover, Mass.	————
Parkinson, John Norman, III, Methuen, Mass.	————
Paulauskas, Louis, VI, Lowell, Mass.	579 Lawrence Street
Pinker, Albert, III, Lawrence, Mass.	————
Walwood, John Thomas, IV, Lowell, Mass.	144 A Street

ALPHABETICAL LIST OF GRADUATES

Master of Science degree was first given in 1936. Other degrees were issued beginning with the year 1913 as follows: B.T.C.—Bachelor of Textile Chemistry; B.T.D.—Bachelor of Textile Dyeing; B.T.E.—Bachelor of Textile Engineering. A diploma is indicated by D and a certificate (covering a partial course only) by C.

The following list has been corrected in accordance with information received previous to February 1, 1941. Any information regarding incorrect or missing addresses is earnestly solicited.

Abbot, Edward Moseley, II, '04 (D). President and General Manager, Abbot Worsted Company, Graniteville, Mass.
Abbott, George Richard, II, '08 (D). Tree Warden, Andover, Mass.
Acar, Ibrahim Zeki, VI, '38 (M.S.). General Textile Engineer, Malatya Textile Mills, Malatya, Turkey.
Adams, Floyd Willington, VI, '16 (B.T.E.).
Adams, Henry Shaw, I, '05 (D). Assistant Treasurer, The Springs Cotton Mills, Chester, S. C.
Adams, Tracy Addison, IV, '11 (D). Vice-President and General Manager, Arnold Print Works, North Adams, Mass.
Aigen, Lawrence, VI, '40 (B.T.E.). Junior Inspector of Textiles, U. S. Army Quartermaster's Depot, Philadelphia, Pa.
Albrecht, Charles Henry, IV, '17 (B.T.C.). Chief Chemist, Atlantic Mills, Providence, R. I.
Allard, Edward Joseph, IV, '31 (B.T.C.). Salesman and Demonstrator, National Aniline & Chemical Company, Providence, R. I.
Allen, Grover Stanley, IV, '34 (B.T.C.). With M. T. Stevens & Sons Co., Haverhill, Mass.
Almquist, George John Edwin, I, '19 (D). Second Vice-President, Passaic-Bergen Lumber Company, Passaic, N. J.
Anderson, Arthur Illman, IV, '24 (B.T.C.). Textile Chemist, Superintendent of Research, American Institute of Laundering, Joliet, Ill.
Anderson, Arthur Julius, IV, '19 (B.T.C.). Salesman, National Aniline and Chemical Company, 40 Rector Street, New York City.
Anderson, Clarence Alfred, VI, '25 (B.T.E.). Cost Department, Hathaway Manufacturing Company, New Bedford, Mass.
Anderson, Harold Robert, II, '26 (D). With Abbot Worsted Company, Forge Village, Mass.
Annan, David, II, '23 (D). 119 Waltham Street, West Newton, Mass.
Anthony, Henry Steere, Jr., IV, '36 (B.T.C.). Assistant Chemist, Tyer Rubber Company, Andover, Mass.
Appel, Mrs. Bessie L. (Lifland, Bessie), IV, '32 (B.T.C.). Assistant Chemist, Massachusetts Knitting Mill, Jamaica Plain, Mass.
Arienti, Peter Joseph, IV, '10 (D). Chief Chemist and Superintendent of Dyeing, Sayles Finishing Plants, Inc., Saylesville, R. I.
Arundale, Henry Barnes, II, '07 (D). 177 Beacon Street, Boston, Mass.
Atwood, Henry Jones, II, '23 (D). Agent, Amos Abbott Company, Dexter, Me.

Babb, Charles Wilkes, Jr., II, '31 (D). With Knox Woolen Company, Camden, Maine.
Babigan, Edward, IV, '33 (B.T.C.). With Outlet Fruit Company, Lowell, Mass.
Babigan, Raymond, IV, '24 (B.T.C.). Examiner, United States Patent Office, Washington, D. C.
Bachelder, Charles Edward, IV, '24 (B.T.C.). Superintendent of Acetate Rayon Division, Tennessee Eastman Corporation, Kingsport, Tenn.
Bagshaw, Herbert Arthur Edward, VI, '32 (B.T.E.). Time Study Department, Worsted Division, Pacific Mills, Lawrence, Mass.
Bailey, Lester Harold, IV, '24 (B.T.C.).
Bailey, Walter James, IV, '11 (D). Bailey's Cleansers and Dyers, Watertown, Mass.
Baker, Franz Evron, VI, '26 (B.T.E.). Instructor, Cotton Yarn Department, Lowell Textile Institute, Lowell, Mass.
Baker, Maurice Sidney, IV, '25 (B.T.C.). Merchant, Baker's Dress Goods Shop, Norwood, Mass.
Baker, Phyllis Jeanne, VI, '39 (B.T.E.). Textile Analyst, Warwick Mills, Boston, Mass.

Baker, William John, IV, '16 (D). Plant Superintendent, E. I. du Pont de Nemours & Co., Buffalo, N. Y.
Balch, Ralph Herman, VI, '29 (B.T.E.). Development Engineer, Celanese Corporation of America, Amcelle, Md.
Baldwin, Frederick Albert, II, '04 (D). President, Federal Clothing Manufacturing Company, Ltd., Sherbrooke, Que.
Banta, John Garrett, VI, '39 (B.T.E.). U. S. Army, Camp Dix.
Bard, Morry Arnold, IV, '30 (B.T.C.). President, Silver Line Dye Works, Inc., New York City.
Barlofsky, Archie, VI, '17 (B.T.E.). Attorney at law, Barlofsky & Barlofsky, Lowell, Mass.
Barr, I. Walwin, I, '00 (D). 1st Vice-President, Buckley Brothers Company, 881 Broadway, New York City.
Barrett, Andrew Edward, IV, '23 (B.T.C.). Field Engineer, Armour & Co., North Bergen, N. J.
Barry, Leo Joseph, II, '27 (D). With Bell Company, Worcester, Mass.
Barry, Marie Gertrude, IV, '32 (B.T.C.). Colorist, National Aniline & Chemical Co., Buffalo, N. Y.
Basdikis, Charles Apostolos, IV, '36 (B.T.C.). 8 Lagrange Street, Lowell, Mass.
Bassett, Louis Loss, VI, '37 (B.T.E.). Manufacturer, Glenbar Fabrics, Lowell, Mass.
Bates, Wesley Elliot, VI, '36 (B.T.E.). Second Hand, Carding & Spinning, Chicopee Manufacturing Corporation, Chicopee Falls, Mass.
Bauer, Frank Norbert, I, '39 (D). Superintendent, Bauer's Ltd., Waterloo, Ont.
Bauer, Harold Conrad, III, '28 (D). With Henry Bauer, Lawrence, Mass.
Beauregard, Albert Joseph, VI, '39 (B.T.E.). Designer and Stylist, Worumbo Manufacturing Company, 51 Madison Avenue, New York City.
Beattie, John Silas, IV, '35 (B.T.C.). Chemist, American Viscose Corporation, Marcus Hook, Pa.
Beck, Frederic Christian, II, '24 (D). In business. Weld & Beck, Southbridge, Mass.
Beeman, Earl Royal, VI, '30 (B.T.E.). General Foreman, Kendall Mills, Colrain, Mass.
Beigbeder, Edgar Raymond, IV, '34 (B.T.C.). Assistant Colorist, National Aniline & Chemical Company, Buffalo, N. Y.
Bell, Edward Benjamin, IV, '24 (B.T.C.). Sub-agent, Calgon, Inc., Lowell, Mass.
Beltramini, Kenneth Charles, VI, '40 (B.T.E.). With Mercantile Stores, Seattle, Wash.
Bennett, E. Howard, II, '03 (C). Publisher, American Wool and Cotton Reporter, 530 Atlantic Avenue, Boston, Mass.
Bentley, Byron, II, '26 (D). With Joseph Bentley Hair Company, Methuen, Mass.
Bergeron, Alvin Wilfred, IV, '29 (B.T.C.). Textile Chemist, Celanese Corporation of America, Amcelle, Md.
Berry, Wilbur French, II, '17 (D). Superintendent, Thomas Kay Woolen Mill Company, Salem, Oreg.
Bertrand, Arthur Leon, IV, '32 (B.T.C.). Inspector of Textiles, Philadelphia Quartermaster Depot, Philadelphia, Pa.
Bethel, Ion Maywood, VI, '39 (M.S.) (B.S., Texas Agricultural and Mechanical College, 1925). Major, U. S. Marine Corps, Officer in Charge of Inspection, Depot of Supplies, Philadelphia, Pa.
Bienstock, George Jerrard, III, '24 (D). Designer and Stylist, Yorkshire Worsted Mills, New York City.
Billings, Borden Dickinson, I, '29 (D).
Bird, Clarence Henry, II, '22 (D). With Schuster Woolen Company, Inc., East Douglas, Mass.
Bird, Francis John, VI, '22 (B.T.E.). Attorney-at-Law, 227 Bronson Building, Attleboro, Mass.
Birtwell, John Lincoln, IV, '34 (B.T.C.). 1641 Gorham Street, East Chelmsford, Mass.
Blaikie, Howard Mills, II, '11 (D). Salesman, Kitchen Kraft Food Corporation, Brooklyn, N. Y.
Blake, Parker Gould, VI, '14 (D). Partner, Parker Blake & Clinton Long, Ltd., 94 Wellington Street, West, Toronto, Ont.
Blanchard, John Lawrence, II, '23 (D). Superintendent, Faith Mills, Inc., Averill Park, N. Y.
Bodwell, Henry Albert, II, '00 (D). Ludlow Manufacturing & Sales Company, 211 Congress Street, Boston, Mass.
Bogdan, John Francis, VI, '35 (B.T.E.). With Manville Jenckes Corporation, Manville, R. I.
Bone, Arthur Peter Stuart, VI, '39 (B.T.E.). Selling and Mill Engineer, Arthur Bone, Inc., Los Angeles, Calif.

Booth, James Mooney, IV, '24 (B.T.C.). Technical Sales, The Huron Milling Company, 9 Park Place, New York City.
Bordett, Sidney Morris, VI, '37 (B.T.E.). Salesman, La France Industries, Boston, Mass.
Bottomley, John, III, '28 (D). Assistant Styler, Joshua L. Bailey & Co., 40 Worth Street, New York City.
Boyd, William, Jr., IV, '40 (B.T.C.). Head Chemist, Ciba Co., Inc., Chicago, Ill.
Boynton, Bradford Lewis, II, '35 (D). With Munro, Kincaid, Edgehill, Inc., Boston, Mass.
Bradford, Edward Hosmer, VI, '35 (B.T.E.). Assistant to Overseer of Carding, Manville-Jenckes Corporation, Manville, R. I.
Bradford, Harold Palmer, II, '25 (D).
Bradford, Roy Hosmer, II, '06 (D). Examiner, Appraiser, Reconstruction Finance Corporation, 161 Devonshire Street, Boston, Mass.
Bradford, William Swanton, VI, '31 (B.T.E.). Tarratine, Somerset Junction, Me.
Bradley, Raymond Frost, VI, '14 (D). Garage Proprietor, Twin Light Garage, 267 East Main Street, Gloucester, Mass.
Bradley, Richard Henry, V, '01 (C). Gasoline Salesman, Fairhaven, Mass.
Brainerd, Arthur Travena, IV, '09 (D). Manager, Ciba Company, Inc., 325 West Huron Street, Chicago, Ill.
Brainerd, Carl Emil, IV, '20 (B.T.C.). Dyer, F. C. Huyck & Sons, Albany, N. Y.
Brandt, Carl Dewey, VI, '20 (B.T.E.). Research Engineer, Whitin Machine Works, Whitinsville, Mass.
Brannen, Leon Vincent, III, '07 (C).
Brantman, Jackson Agmor, VI, '39 (B.T.E.). Textile Technician, Golding Brothers Company, Inc., New York City.
Brickett, Raymond Calvin, II, '14 (D). Overseer, M. T. Stevens & Sons Company (Marland Mills), Andover, Mass.
Bridges, Herbert Gardner, II, '34 (D). Manager, Portsmouth Office, The New Hampshire Company, Portsmouth, N. H.
Brigham, Howard Mason, VI. '24 (B.T.E.). Sales Executive, Wellington, Sears Co., 65 Worth Street, New York City.
Broadhurst, Russell Denton, IV, '38 (B.T.C.). 2 Laurel Street, Middletown, Conn.
Bronson, Howard Seymour, II, '27 (D). Overseer of Knitting, Portage Hosiery Company, Portage, Wis.
Brosnan, William Francis, IV, '27 (B.T.C.). Superintendent of Bleaching and Dyeing, American Thread Company, Kerr Mills, Fall River, Mass.
Brown, Gerald Marston, VI, '22 (B.T.E.). With Monomac Spinning Company, Lawrence, Mass.
Brown, Philip Franklin, II, '23 (D). Assistant Sales Director, E. I. DuPont de Nemours, Rayon Division, Wilmington, Del.
Brown, Rollins Goldthwaite, IV, '12 (D). Representative, Investors Syndicate, Chamber of Commerce Building, Boston, Mass.
Brown, Russell Lee, VI, '21 (B.T.E.). '40 (M.S.). Assistant Professor, Department of Woolen Yarns, Lowell Textile Institute, Lowell, Mass.
Brown, Will George, Jr., IV, '22 (B.T.C.). Sales Engineer, Wallerstein Company, 180 Madison Avenue, New York City.
Buchan, Donald Cameron, II, '01 (D). Assistant Superintendent, M. T. Stevens & Sons Company, North Andover, Mass.
Buchan, Norman Spaulding, IV, '26 (B.T.C.). Textile Chemist, Newmarket Manufacturing Company, Lowell, Mass.
Buckley, Herman Timothy, IV, '39 (B.T.C.). Assistant Chemist, J. L. Stifel & Sons, Wheeling, W. Va.
Bukala, Mitchell John, IV, '34 (B.T.C.). Chemist, Massachusetts Mohair Plush Company, Lowell, Mass.
Bullock, Merlen Clarke, VI, '40 (B.T.E.). Student, Massachusetts Institute of Technology, Cambridge, Mass.
Burbeck, Dorothy Maria, IV, '20 (B.T.C.). See Garlick, Mrs. Dorothy M.
Burger, Samuel Joseph, III, '24 (D). President, Heat Maintenance Service, Inc., Brooklyn, N. Y.
Burke, James Edward, Jr., IV, '34 (B.T.C.). Police Officer, Lowell Police Department, Lowell, Mass.
Burnham, Frank Erwin, IV, '02 (D). Chemist and Dyer, Henry Klous, Inc., Lawrence, Mass.
Burns, Robert, IV, '28 (B.T.C.). With Celanese Corporation of America, 180 Madison Avenue, New York City.
Burtt, Joseph Frederic, VI, '31 (B.T.E.). Assistant to Superintendent, Abbott Worsted Company, Forge Village, Mass.
Buzzell, Harry Saville, VI, '29 (B.T.E.). Supervisor, Oxford Paper Company, Rumford, Maine.

Calder, Marian Brownson, VI, '37 (M.S.). (B.S. 1930, College of Industrial Arts, Texas State College for Women.) With Good Housekeeping Institute, New York City.
Callahan, John Joseph, Jr., II, '26 (D). Color Chemist, Technicolor Motion Picture Corporation, Boston, Mass.
Cameron, Elliott Francis, IV, '11 (D). Attorney-at-law, Willard, Allen and Mulkern, 100 Milk Street, Boston, Mass.
Campbell, Alexander, VI, '23 (B.T.E.). Assistant Engineer, Arlington Mills, Lawrence, Mass.
Campbell, Allan, Jr., VI, '32 (B.T.E.). With A. & A. Campbell Co., South Boston, Mass.
Campbell, Andrew Morris, IV, '40 (B.T.C.). South Main Street, Andover, Mass.
Campbell, Louise Porter, IIIb, '03 (C). With Ginn & Co., 15 Ashburton Place, Boston, Mass.
Campbell, Orison Sargent, II, '03 (D). President and Manager, Industrial Felts, Ltd., New Hamburg, Ont.
Cannell, Philip Stuart, VI, '23 (B.T.E.). Hotel Proprietor, Carlton Hotel, Malden, Mass.
Carbone, Alfred John, IV, '31 (B.T.C.). Chemist, Sandoz Chemical Works, Philadelphia, Pa.
Carleton, Joseph Raddin, III, '30 (D). Designer, Bridgeport Fabrics, Inc., Bridgeport, Conn.
Carr, George Everett, I, '05 (D). 343 5th Street, Ridgefield Park, N. J.
Carr, Paul Edward, II, '24 (D). Manager of Woolen Division, L. C. Chase & Co., Inc., 295 Fifth Avenue, New York City.
Carter, Robert Albion, IV, '02 (D). Dyestuff Salesman, E. I. du Pont de Nemours & Co., Greenfield, Reading, Pa.
Carter, Russell Albert, II, '25 (D). Textile Engineer, Hampton Company, Easthampton, Mass.
Cary, Julian Clinton, VI, '10 (D). Connecticut Manager, The American Mutual Liability Insurance Company, 15 Lewis Street, Hartford, Conn.
Casey, Francis Harold, IV, '31 (B.T.C.). Textile Chemist, Sandoz Chemical Works, Inc., Boston, Mass.
Caya, Ferdinand Joseph, IV, '22 (B.T.C.). Textile Chemist, Gotham Silk Hosiery Company, Inc., Wharton, N. J.
Chamberlin, Frederick Ellery, I, '03 (D). Overseer of Spinning, Monument Mills, Housatonic, Mass.
Chandler, Proctor, IV, '11 (D). With Packard Mills, Webster, Mass.
Chang, Chi, VI, '23 (B.T.E.).
Chang, Wen Chuan, VI, '21 (B.T.E.). Dah Sung Cotton Spinning & Weaving Co., 392 Nanking Road, Shanghai, China.
Chapman, Leland Hildreth, VI, '24 (B.T.E.). Teacher, High School, Hingham, Mass.
Chen, Shih Ching, IV, '22 (B.T.C.).
Chen, Wen-Pei, IV, '24 (B.T.C.). Shanghai Bureau of Inspection, Shanghai, China.
Church, Charles Royal, II, '06 (C). Teacher, San Diego High School, San Diego, Calif.
Churchill, Charles Whittier, III, '06 (D). Manager, Churchill Manufacturing Company, Inc., Lowell, Mass.
Clark, Earl William, IV, '18 (B.T.C.). Research Chemist, National Aniline & Chemical Co., Inc., Buffalo, N. Y.
Clark, Thomas Talbot, II, '10 (D). President and Treasurer, Talbot Mills, North Billerica, Mass.
Clarke, George Dean, II, '21 (C). 338 East Main Street, Avon, Mass.
Clayton, Harold Edmund, VI, '21 (B.T.E.). Treasurer and Manager, Clayton Hosiery Mills, Inc., Lowell, Mass.
Cleary, Charles Joseph, II, '13 (D). Senior Materials Test Engineer, United States Army Air Corps, Dayton, Ohio.
Clement, David Scott, IV, '24 (B.T.C.). Overseer of Dyeing, Nashua Manufacturing Company, Nashua, N. H.
Cleveland, Richard Sumner, VI, '30 (B.T.E.). Associate Materials Engineer, U. S. Maritime Commission, Washington, D. C.
Clifford, Albert Chester, VI, '22 (B.T.E.). Textile Engineer, Western Electric Company, Inc., Kearny, N. J.
Clogston, Raymond B., IV, '04 (D). Divisional Superintendent of Dyeing, Merrimack Manufacturing Company, Lowell, Mass.
Cluett, John Girvin, I, '29 (D). Sanforizing Engineer, Cluett, Peabody & Co., Inc., Troy, N. Y.
Coan, Charles Bisbee, IV, '12 (D). Salesman, American Aniline Products Company, Boston, Mass.

Cobb, Joseph Calvin, VI, '36 (B.T.E.). Office Manager and Representative, Middlesex Paper Tube Company of New Jersey, Trenton, N. J.

Cobin, Arthur Edward, IV, '23 (B.T.C.). With National Hosiery Dyeing and Finishing Works, Boston, Mass.

Coffey, Daniel Joseph, III, '28 (D). Blanket Inspector, F. C. Huyck & Sons, Rensselaer, N. Y.

Cohen, Leonard Lee, II, '39 (D). 237 Berkeley Street, Rochester, N. Y.

Cohen, Raphael Edvab, IV, '25 (B.T.C.). Sales Manager, Merrimack Paper Tube Company, Inc., Lowell, Mass.

Colby, J. Tracy, VI, '16 (D). Sales Manager, F. C. Huyck & Sons, Empire State Building, Room 3318, New York City.

Colby, Vernon Warren, IV, '40 (B.T.C.). Assistant Dyer, J. L. Stifel & Sons, Inc., Wheeling, W. Va.

Colby, Willard Alvah, Jr., IV, '30 (B.T.C.). Overseer of Dyeing, Danvers Bleachery, Peabody, Mass.

Cole, Edward Earle, IV, '06 (D). Manager, Haverhill Credit Bureau, Bradford, Mass.

Collonan, Herbert Joseph, II, '22 (D). With Potter & Collonan, Moosup, Conn.

Coman, James Groesbeck, I, '07 (D). Manager, Mexia Textile Mills, Mexia, Texas.

Conant, Harold Wright, I, '09 (D). Assistant Treasurer and Director, United Elastic Corporation, Easthampton, Mass.

Conant, Richard Goldsmith, I, '12 (D). Sales Executive, Wellington, Sears Company, 65 Worth Street, New York City.

Conklin, Jennie Grace, IIIb, '05 (C). See Nostrand, Mrs. William L.

Connolly, Daniel Francis, Jr., VI, '35 (B.T.E.). 476 Lafayette Street, Salem, Mass.

Connor, Thomas Francis, II, '28 (D). Court Officer, Superior Court, Suffolk County, Boston, Mass.

Connorton, John Joseph, III, '27 (D). Assistant Agent, Amoskeag Fabrics, Inc., Manchester, N. H.

Cook, Kenneth Bartlett, I, '13 (D). Vice-President in Charge of Manufacturing, Manville-Jenckes Company, Manville, R. I.

Corbett, James Francis, IV, '28 (B.T.C.). Chemist, Pacific Mills, Lawrence, Mass.

Cote, Theodore Charles, IV, '26 (B.T.C.). Captain, Medical Administration Corps, U. S. Army, Fort Devens, Mass.

Cowan, Raymond Bernard, IV, '35 (B.T.C.). Of Cowan & Shain, Haverhill, Mass.

Craig, Albert Wood, IV, '07 (D). Superintendent, Windsor Print Works, North Adams, Mass.

Craig, Clarence Eugene, III, '02 (D). 1730 Centre Street, West Roxbury, Mass.

Crane, Eugene Francis, II, '33 (D). With East Weymouth Wool Scouring Company, East Weymouth, Mass.

Crawford, Robert Thomas, VI, '36 (B.T.E.). Assistant Superintendent, Acetate Staple Department, Tennessee Eastman Corporation, Kingsport, Tenn.

Creese, Guy Talbot, IV, '14 (D). General Manager, Creese & Cook Company, Danversport, Mass.

Crowe, Joseph Bailey, IV, '25 (B.T.C.). Director of Laundry and Textile Research, Procter & Gamble Co., Ivorydale, Ohio.

Culver, Ralph Farnsworth, IV, '04 (D). Vice-President and Manager, Providence Office, Ciba Company, Inc., 61 Peck Street, Providence, R. I.

Cummings, Edward Stanton, VI, '16 (D). Industrial Engineer, Ralph E. Loper Company, Greenville, S. C.

Curran, Charles Ernest, III, '02 (C). Head Designer, Wood Worsted Mills, Lawrence, Mass.

Currier, John Alva, II, '01 (D). Mechanical Superintendent, M. T. Stevens & Sons Co., North Andover, Mass.

Curtin, William John, IV, '35 (B.T.C.). District Manager, Lowell Sun, Lowell, Mass.

Curtis, Frank Mitchell, I, '06 (D). Salesman, Barney & Carey Company, Milton, Mass.

Curtis, William Leavitt, II, '05 (C).

Cutler, Benjamin Winthrop, Jr., III, '04 (D). Department Manager, Worth Textile Company, 40 Worth Street, New York City.

Daley, Charles Lincoln, IV, '34 (B.T.C.). Instructor, Chemistry Department, Lowell Textile Institute, Lowell, Mass.

Dalton, Gregory Smith, IV, '12 (D).

Daly, William James, VI, '37 (B.T.E.). Textile Inspector, Jeffersonville Quartermaster Depot, Jeffersonville, Ind.

Darby, Avard Nelson, II, '28 (D). Superintendent, Plant No. 2, Merrimac Hat Corporation, Amesbury, Mass.
Datar, Anant Vithal, VI, '24 (B.T.E.). Managing Director, Venkatesh Rang Tantu Mills, Inchalkaranji, S. M. Cy., India.
Davidson, Sydney, III, '28 (D). 301 Allston Street, Brighton, Mass.
Davieau, Alfred Edward, VI, '16 (D). Textile Consulting Engineer, United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J.
Davieau, Arthur Napoleon, VI, '13 (D). Superintendent, Kenwood Mills, Ltd., (F. C. Huyck & Sons), Arnprior, Ont.
Davieau, Leon Arthur, VI, '23 (B.T.E.). Textile Engineer, United States Rubber Company, Passaic, N. J.
Davis, Alexander Duncan, VI, '14 (B.T.E.). Instructor, Northeastern University, Springfield, Mass.
Davis, Arthur Sabin, IV, '40 (B.T.C.). Textile Chemist, United States Testing Company, Hoboken, N. J.
Dearborn, Roy S., VI, '13 (D). With Real Estate Department, Andover Savings Bank, Andover, Mass.
Del Plaine, Parker Haywood, IV, '25 (B.T.C.). Southern Manager, Rohm & Hass Company, Inc., 1109 Independent Building, Charlotte, N. C.
Dempsey, Phillip Edward, IV, '33 (B.T.C.). Chemist, American Aniline Products, Inc., Boston, Mass.
Derby, Roland Everett, IV, '22 (B.T.C.). Proprietor–Chief Chemist, The Derby Company, Lawrence, Mass.
Derzawetz, Joseph, VI, '39 (B.T.E.). Research and Testing Assistant, Gotham Silk Hosiery Company, Inc., Wharton, N. J.
de Sa, Francisco, VI, '18 (B.T.E.). Avenue da Graca, Bahia, Brazil.
Dewey, James French, II, '04 (D). President, Woolen Mill, A. G. Dewey Company, Quechee, Vt.
Dewey, Maurice William, II, '11 (D). Investments, National Life Insurance Company, Montpelier, Vt.
Dick, Henry Kendal, Jr., VI, '39 (B.T.E.). Textile Research, Talon, Inc., Meadville, Pa.
Dillon, James Henry, III, '05 (D).
Dion, Ernest Lorenzo, IV, '35 (B.T.C.). Chemist, Zinsser & Company, Hastings on Hudson, N. Y.
Dods, James Barber, II, '27 (D). Vice-President, The Dods Knitting Company, Ltd., Orangeville, Ont.
Dolan, William Francis, IV, '28 (B.T.C.).
Donald, Albert Edward, II, '04 (D). Agent, H. T. Hayward Company, Franklin, Mass.
Donohoe, Edward Joseph, VI, '34 (B.T.E.). Manager, New York Laboratory, United States Testing Company, Inc., 1450 Broadway, New York City.
Donovan, Joseph Richard, IV, '24 (B.T.C.).
Doran, Wilbur Kirkland, II, '22 (D).
Dorr, Clinton Lamont, VI, '14 (D). General Manager, Raymond's, Inc., 356 Washington Street, Boston, Mass.
Douglas, Walter Shelton, II, '21 (D). Estimator, Douglas & Co., Lowell, Mass.
Dudley, Albert Richard, VI, '33 (B.T.E.). Chicopee Manufacturing Corporation, Manchester, N. H.
Duggan, Paul Curran, IV, '31 (B.T.C.). Dyer, Sussex Dye & Print Works, Newton, N. J.
Duguid, Harry Wyatt, I, '24 (D). Assistant Superintendent, Maverick Mills, East Boston, Mass.
Dunlap, Kirke Harold, Jr., VI, '30 (B.T.E.). Textile Engineer, Kenwood Mills, Ltd., Arnprior, Ont.
Dunlap, Parker Frank, VI, '34 (B.T.E.). Textile Engineer, Chicopee Manufacturing Corporation, Manchester, N. H.
Dunnican, Edward Tunis, VI, '24 (B.T.E.). Instructor in Textile Shop Practice, Passaic Public Schools, Passaic, N. J.
Durgin, William Ernest, IV, '24 (B.T.C.). Textile Chemist, Geigy Company, Inc., 88 Broad Street, Boston, Mass.
Dursin, Louis Jules, II, '36 (D). Superintendent, Rochambeau Worsted Company, Providence, R. I.
Duval, Joseph Edward, II, '10 (D). Sales Manager, Massachusetts Mohair Plush Company, 3701 North Broad Street, Philadelphia, Pa.
Dwight, John Francis, Jr., II, '08 (D). Hazel Avenue, Scituate, Mass.

Echavarria, Luis, VI, '35 (B.T.E.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia.

Echecopar, Jesus Fortunato, VI, '33 (B.T.E.). Director-Gerente de Eguren, Echecopar y Cia. S.A. and Profesor de Tecnologia Textil en la Escuela de Ingenieros, Lima, Peru.

Echmalian, John Gregory, VI, '16 (B.T.E.). Director, State Trade School, Manchester, Conn.

Ehrenfried, Jacob Benjamin, II, '07 (C). District Manager, Maine Unemployment Compensation Commission, Lewiston, Me.

Eismann, Edmund, IV, '35 (B.T.C.). Assistant Chemist, Fruit of the Loom, Inc., Pontiac, R. I.

Ekstrand, Frederic Lawrence, II, '39 (D). New England Representative, Borne Scrymser Company of New York City, Stafford Springs, Conn.

Elliot, Gordon Baylies, II, '12 (D). Planning Department, Pacific Mills, Worsted Division, Lawrence, Mass.

Ellis, Charles Albert, VI, '21 (B.T.E.). With Scott & Williams, Inc., Laconia, N. H.

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Gallagher, John Waters, II, '27 (D). Card Room Foreman, Newmann Endler, Inc., Danbury, Conn.

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Goodhue, Amy Helen, IIIb, '00 (C). See Harrison, Mrs. Arthur.
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Gross, Herman Peter, IV, '30 (B.T.C.). Plant Manager, Lincoln Rug Company, East Newark, N. J.
Grossman, Clinton, IV, '38 (B.T.C.). Dyer, Lebanon Knitting Mills, Inc., Pawtucket, R. I.
Guild, Lawrence Winfield, VI, '27 (B.T.E.). Sales Executive President, L. W. Guild Company, Inc., 140 Harrison Avenue, Boston, Mass.
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Hadley, Walter Eastman, IV, '08 (D). Chief Chemist, Standard Coosa Thatcher Company, Rossville, Ga.
Hadley, Wilfred Nourse, II, '22 (D). Manager, Parks & Woolson Machine Company, Springfield, Vt.
Hager, Hazen Otis, II, '21 (C). Manager, Suburban Gas Company and Hagar Auto Parts, Portland, Me.
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Hammond, Chester Twombly, II, '23 (D). President and Manager, Niagara Rug & Carpet Company, Inc., Buffalo, N. Y.
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Harmon, Charles Francis, I, '99 (D).
Harpoot, Burgess Charles, VI, '38 (B.T.E.). 185 Liberty Street, Lowell, Mass.
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Hart, Arthur Norman, IV, '19 (B.T.C.).
Hart, Howard Roscoe, I, '23 (D). Vice-President, Southern Brighton Mills, Shannon, Ga.
Harwood, Ralph, IV, '35 (B.T.C.).
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Hennigan, Arthur Joseph, II, '06 (D).
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Huising, Geronimo Huerva, I, '08 (D).
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Knox, Joseph Carleton, VI, '23 (B.T.E.). (S.M. 1937, Harvard University.) Assistant Sanitary Engineer, Massachusetts Department of Public Health, Boston, Mass.
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Kolsky, Samuel Irving, IV, '30 (B.T.C.). Manager, Kolsky Jewelry Co., Lawrence, Mass.
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Krishan, Maharaj, VI, '30 (B.T.E.). Montgomery, India.
Kuo, Limao, VI, '26 (B.T.E.). In charge of Quality Testing Division, Shanghai Bureau of Inspection and Testing of Commercial Commodities, Shanghai, China.

Lamb, Arthur Franklin, II, '10 (D). In business, Cleansing and Dyeing, Lamb's Cleaning, Rockland, Maine.
Lamont, Robert Laurence, II, '12 (D). Secretary, L. F. Grammes & Sons, Inc., Allentown, Pa.
Lamprey, Leslie Balch, IV, '16 (B.T.D.). Lawrence Post Office, Lawrence, Mass.
Lamson, George Francis, I, '00 (D). Engineering Department, Riley Stoker Corporation, Worcester, Mass.
Lane, John William, I, '06 (C.).
Lane, Oliver Fellows, IV, '15 (B.T.D.). Technical Service, Sales Department, Krebs Pigment and Color Corp., Newark, N. J.
Lanner, Arthur William, IV, '40 (B.T.C.). Junior Chemist, Naval Clothing Depot, Brooklyn, N. Y.
Larratt, John Francis, II, '22 (D). Gift Studio, Studio 5, El Paseo, Santa Barbara, Calif.
Lauder, Robert William, VI, '35 (B.T.E.). Abbot Worsted Company, Forge Village, Mass.

Laughlin, James Knowlton, III, '09 (D).
Laurin, Eric Thursten Lawrence, IV, '21 (B.T.C.). Director of Textile Service, Calgon, Inc., 300 Ross Street, Pittsburgh, Pa.
Laurin, Sven Albert, IV, '23 (B.T.C.). Minister, Tenney Memorial Church, Salem, N. H.
Lawson, Russell Monroe, VI, '34 (B.T.E.). Designer, Goodall Worsted Company, Sanford, Me.
Leavitt, George Herbert, II, '26 (D). Night Assistant Superintendent, F. C. Huyck & Sons, Albany, N. Y.
Leblanc, Gerald Alderic, VI, '34 (B.T.E.). With Lowell Furniture Company, Lowell, Mass.
Lee, Shao-fong, VI, '36 (B.T.E.).
Lee, William Henry, II, '05 (C). Treasurer, John H. Lee & Son, Holyoke, Mass.
Lehto, Reino Gust, III, '38 (D). 24 Waltham Street, Maynard, Mass.
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Lemieux, Robert Alphonse, IV, '38 (B.T.C.). Textile Chemist, Penick & Ford, Ltd., Inc., 420 Lexington Avenue, New York City.
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Leonard, Leo Edward, I, '27 (D).
Leslie, Kenneth Everett, IV, '35 (B.T.C.). Textile Chemist, Ciba Company, Inc., 434 East Allegheny Avenue, Philadelphia, Pa.
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Lewis, LeRoy Clark, IV, '08 (D). 112 Kingston Avenue, Hawthorne, N. J.
Lewis, Walter Scott, IV, '05 (D). Farm Credit Administration, U. S. Government, Washington, D. C.
Lifland, Abraham, IV, '31 (B.T.C.). Assistant Dyer, Artistic Dyeing Company, Brooklyn, N. Y.
Lifland, Bessie, IV, '32 (B.T.C.). See Appel, Mrs. Bessie L.
Lifland, Morris, VI, '33 (B.T.E.).
Lillis, Marvin Hale, IV, '14 (D). 40 Lawrence Street, Lawrence, Mass.
Lincoln, Charles Ernest, IV, '37 (B.T.C.). Superintendent, Collins & Aikman Corporation, Manyunk, Philadelphia, Pa.
Lindsly, Walter Coburn, IV, '29 (B.T.C.). Chemist, Sidney Blumenthal & Co., Inc., Shelton, Conn.
Linsey, Edward, II, '25 (D).
Little, Ralph Harding, II, '39 (D). Assistant Designer, M. T. Stevens & Sons, Peace Dale, R. I.
Littlefield, Carl Richard, VI, '38 (B.T.E.). With Asbestos Textile Company, North Brookfield, Mass.
Lizak, Boleck Louis, IV, '40 (M.S.). (B.S., Lewis Institute, 1937.) Chemist, Morgan Dyeing & Bleaching Co., Rochelle, Ill.
Logan, George Leslie, VI, '28 (B.T.E.). Secretary, Tompkins Brothers Company, Syracuse, N. Y.
Lokur, Swamirao Ramrao, IV, '35 (B.T.C.). With Lolana Textile Industries, Thalakwadi, Belgaum, India.
Lombard, Carleton Joshua, VI, '23 (B.T.E.). Vice-President, Riggs & Lombard, Textile Machinery, Lowell, Mass.
Loney, Robert William, II, '22 (D). F. C. Huyck & Sons, Kenwood Mills, Albany, N. Y.
Longbottom, Parker Wyman, IV, '21 (B.T.C.). Dyer, Claremont Waste Manufacturing Company, Claremont, N. H.
Loveless, Everton Hanscom, VI, '31 (B.T.E.). Assistant Superintendent, Cotton and Rayon Division Lorraine Manufacturing Company, Pawtucket, R. I.
Lowe, John Charles, VI, '34 (B.T.E.), '40 (M.S.). Assistant Professor, Department of Worsted Yarns, Lowell Textile Institute, Lowell, Mass.
Lowe, Philip Russell, VI, '24 (B.T.E.). Adjuster, Factory Mutual Fire Insurance Companies, Boston, Mass.
Lucey, Edmund Ambrose, II, '04 (D). Partner, Lucey Knitwear Company and Consulting Engineer, 15 East 26th Street, New York City and Manchester, Conn.
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Lynch, Edward Mark, IV, '40 (B.T.C.). Chemical Technologist, The Derby Company, Lawrence, Mass.

McAllister, Gordon Algeo, IV, '31 (B.T.C.). North Billerica, Mass.
McCann, John Joseph, Jr., VI, '24 (B.T.E.). Textile Machine Designer, The McCann Company, River Works, Andover, Mass.
McCool, Frank Leslie, IV, '10 (D). Resident Manager, Sandoz Chemical Works, Inc., Providence, R. I.
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McDonald, John Joseph, IV, '32 (B.T.C.). Teacher of Testing and Dyeing, Textile High School, New York, N. Y.
McDonnell, William Henry, I, '06 (C). Court Judge, 40 Court Street, Boston, Mass.
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McGilly, John Seede, VI, '40 (B.T.E.). Assistant in Merchandising, Real Silk Hosiery Mills, Inc., Indianapolis, Ind.
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MacKay, Stewart, III, '07 (D). Assistant Professor of Textile Design, Lowell Textile Institute, Lowell, Mass.
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McKinnon, Norman, VI, '29 (B.T.E.). With Sidney Blumenthal, South River, N. J.
McKinstry, James Bradley, II, '25 (D). Agent and Superintendent, H. T. Hayward Company, Franklin, Mass.
McKittrick, Raymond Wellington, VI, '28 (B.T.E.). Manager, C. S. Dodge Company, Lowell, Mass.
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McQuade, Allan John, VI, '36 (B.T.E.). Textile Inspector, Jeffersonville Quartermaster Depot, Jeffersonville, Ind.
McQuaid, Barton Mathewman, IV, '32 (B.T.C.). Billerica, Mass.
Macher, Henry, II, '23 (D). Secretary, Central Importing Company, Inc., of New Jersey, Passaic, N. J.
Mackle, Chauncey Jacob, II, '40 (D). With Barre Wool Combing Company, Ltd., South Barre, Mass.
Maguire, James Joseph, II, '28 (D). Designer, Uxbridge Worsted Company, Uxbridge, Mass.
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Mahoney, Joseph Healey, IV, '38 (B.T.C.). With City Dye Works, Springfield, Mass.
Mailey, Howard Twisden, II, '08 (D). Manufacturing Superintendent, Worsted Division, Pacific Mills, Lawrence, Mass.
Manderbach, Harold Mills, VI, '37 (M.S.). (**B.A. 1924, University of Michigan.**) Captain, U. S. Army Quartermaster's Depot, Philadelphia, Pa.
Manning, Frederick David, IV, '10 (D). Industrial Engineer, General Cable Corporation, 420 Lexington Avenue, New York City.
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Mark, Aris Sawa, VI, '22 (B.T.E.). Sales Department, Franklin Manufacturing Company, Inc., 40 Worth Street, New York City.
Markarian, Haig, IV, '33 (B.T.C.). Dye House, Arlington Mills, Lawrence, Mass.
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Marsden, Sidney Robert, IV, '39 (B.T.C.).
Marshall, Chester Stanley, II, '22 (D). Superintendent, Peerless Weaving Company, Pawtucket, R. I.
Martin, Harry Warren, IV, '11 (D). Manager of Footwear, Hood Rubber Company, Inc., Watertown, Mass.

Maslanka, Edward John Felix, IV, '40 (B.T.C.). Training, Naval Reserve, Abbott Hall, Chicago, Ill.
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Mathieu, Alfred Jules, II, '20 (D). Salesman, Dyeing and Combing, French Worsted Company, Woonsocket, R. I.
Matthews, Elmer Clark, II, '17 (D). Treasurer and General Manager, Thermo Mills, Inc., Hudson, N. Y.
Matthews, Raymond Lewis, IV, '34 (B.T.C.). Overseer of Dyeing, Crompton Shenandoah Company, Waynesboro, Va.
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Mauersberger, Herbert Richard Carl, III, '18 (D). Technical Editor, Rayon Publishing Corporation, 303 Fifth Avenue, New York City.
Mazer, Samuel, IV, '26 (B.T.C.). In business, Dyer and Converter of Yarns, S. Mazer & Co., Allston, Mass.
Meadows, William Ransom, I, '04 (D). Cotton Registrar, Chicago Board of Trade, Chicago, Ill.
Meehan, John Joseph, IV, '32 (B.T.C.). Textile Colorist, Warwick Print Works, Bound Brook, N. J.
Meek, Lotta, IIIb, '07 (C). See Parker, Mrs. Herbert L.
Meeker, Samuel, IV, '27 (B.T.C.). Chemist, Aridye Corporation, Fairlawn, N. J.
Megas, Charles, IV, '37 (B.T.C.). Veterans' Facility Administration, Bedford, Mass.
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Mejia, Eduardo, B.S., I, '40 (D). Medellin, Colombia, S. A.
Merchant, Edith Clara, IIIb, '00 (C). Supervisor of Drawing, Public Schools, Lowell, Mass.
Merrill, Allan Blanchard, IV, '11 (D). Technical Superintendent, B. F. Goodrich Company, Akron, Ohio.
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Merritt, Charles Adelbert, II, '39 (D). Assistant Designer, Knox Woolen Company, Camden, Me.
Meyers, Chester William, IV, '27, (B.T.C.). Dyer, Massachusetts Knitting Mills, Jamaica Plain, Mass.
Midwood, Arnold Joseph, IV, '05 (D), Salesman, E. I. du Pont de Nemours & Co., 140 Federal Street, Boston, Mass.
Miller, Arnold Irving, IV, '39 (B.T.C.). Junior Inspector of Textiles, U. S. A. Quartermaster Corps, Philadelphia, Pa.
Miller, Joshua, VI, '24 (B.T.E.). Material Engineer, Naval Aircraft Factory, Navy Yard, Philadelphia, Pa.
Minge, Jackson Chadwick, I, '01 (C).
Mirsky, Leon Robert, II, '19 (D). 229 West 97th Street, New York City.
Mitchell, Charles Alvah, II, '24 (D).
Moller, Ernest Arthur, II, '22 (D). Assistant District Manager, The Goodyear Tire & Rubber Co., Inc., Baltimore, Md.
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Moody, Leon Eugene, IV, '34 (B.T.C.). Resident Manager, U. S. Finishing Company, Sterling, Conn.
Moore, Edward Francis, II, '25 (D). Superintendent, The Adler Company, Cincinnati, Ohio.
Moore, Everett Byron, I, '05 (D). With Bridgeport Coach Lace Company, Bridgeport, Conn.
Moore, Karl Remick, IV, '11 (D). Chemist, Mohawk Carpet Mills, Amsterdam, N. Y.
Moore, William Joseph, IV, '21 (B.T.C.). Colorist, Pacific Mills, Lawrence, Mass.
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Moreno, Emilio Gomez, Jr., VI, '36 (B.T.E.). Draftsman, Whitin Machine Works, Whitinsville, Mass.
Morrill, Howard Andrew, VI, '16 (D).
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Morrison, Roland Charles, IV, '34 (B.T.C.). Dye Salesman, Calco Chemical Division, American Cyanamid Company, Providence, R. I.
Morse, Judson Pickering, II, '33 (D). With Eagle Oil & Supply Company, South Boston, Mass.
Mullaney, John Francis, VI, '20 (B.T.E.). Higgins & Mullaney, 303 Chalifoux Building, Lowell, Mass.
Mullen, Arthur Thomas, II, '09 (D). Industrial Shop Manager, Commonwealth of Massachusetts, West Concord, Mass.
Munroe, Sydney Philip, I, '12 (D). Cost Executive, Wellington Sears Company, New York City.
Murphy, Hubert James, IV, '39 (B.T.C.). Chemist and Dyer, Atlantic Rayon Corporation, Providence, R. I.
Murphy, John Joseph, IV, '33 (B.T.C.). Assistant Chemist, Bates Manufacturing Company, Lewiston, Me.
Murray, James, IV, '13 (D). Chief Chemist, Martin Cantine Company, Saugerties, N. Y.
Murray, James Andrew, II, '10 (D). Analyst, Massachusetts Unemployment Compensation Commission, Boston, Mass.
Myers, Walter Flemings, VI, '29 (B.T.E.). Salesman, Atlantic Register Company, Waltham, Mass.

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Natsios, Basil Andrew, IV, '37 (B.T.C.). 176 Cross Street, Lowell, Mass.
Nelson, Roy Clayton, II, '21 (C). Resident Manager, Assabet Mills, Maynard, Mass.
Nelson, Russell Sprague, VI, '22 (B.T.E.). With Draper Corporation, Hopedale, Mass.
Nelson, William Arthur, IV, '40 (B.T.C.). With Pacific Mills, Lawrence, Mass.
Nerney, Francis Xavier, IV, '37 (B.T.C.). Sales Service, Buffalo Electro-Chemical Company, Buffalo, N. Y.
Neugroschl, Sigmond Israel, I, '21 (D).
Newall, J. Douglas, IV, '09 (D). Agent, Boston Duck Company and Bondsville Bleachery & Dye Works, Bondsville, Mass.
Newcomb, Guy Houghton, IV, '06 (C). Manager, Philadelphia Dye Sales, E. I. du Pont de Nemours & Co., 1616 Walnut Street, Philadelphia, Pa.
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Niven, Robert Scott, VI, '12 (D). Drafting Department, General Electric Company, Lynn, Mass.
Nostrand, Mrs. William L. (Conklin, Jennie Grace), IIIb, '05 (C).
Nuttall, Andrew Frederick, IV, '40 (B.T.C.). With Merrimack Manufacturing Company, Lowell, Mass.

O'Brien, Philip Francis, II, '15 (D). (B.S. New York University, M.A. Fordham University.) Chairman, Textile Department, Textile High School, New York City.
Ocoma, Estanislao Manaois, B.S., VI, '39 (B.T.E.). With Nadeco Cotton Mills, Manila, P. I.
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O'Connor, Lawrence Dennis, VI, '17 (D). With Beggs & Cobb, Winchester, Mass.
O'Donnell, John Delaney, I, '04 (C).
O'Donoghue, Eileen Margaret, VI, '39 (B.T.E.). With Pacific Mills, 214 Church St., New York City.
O'Hara, William Francis, IV, '04 (C). Chemist, Original Bradford Soap Works, West Warwick, R. I.
Olsen, Earl Edward, VI, '38 (B.T.E.). Textile Engineer, Jamestown Worsted Mills, Jamestown, N. Y.
Olsen, Herbert Charles, IV, '39 (B.T.C.). Textile Chemist, National Starch Products, Inc., 820 Greenwich Street, New York City.
Olson, Carl Oscar, II, '24 (D). Proprietor, Budget Beauty Salon, Hartford, Conn.

Orlanski, Anthony, IV, '32 (B.T.C.). Dyer, Bradford Dyeing Association, Bradford, R. I.

Orr, Andrew Stewart, IV, '22 (B.T.C.). Manager, Storey & Co., Brockton, Mass.

Osborne, George Gordon, VI, '28 (B.T.E.). (M. Sc. 1932, North Carolina State College.) With Wellington, Sears Company, Boston, Mass.

Othote, Louis Joseph, I, '23 (D). Sales and merchandising, J. W. Valentine Co., Inc., 40 Worth Street, New York City.

Paige, Walter Hale, Jr., VI, '38 (B.T.E.). Paul Whitin Manufacturing Company, Northbridge, Mass.

Palais, Samuel, IV, '18 (B.T.C.). With Worcester Knitting Company, Worcester, Mass.

Parechanian, James Humphrey, IV, '35 (B.T.C.), '38 (M.S.).

Parigian, Harold Hrant, IV, '28 (B.T.C.).

Parker, Everett Nichols, I, '05 (D). President, Parker Spool and Bobbin Company, 27-53 Middle Street, Lewiston, Maine.

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Parker, Hubert Frederic, VI, '20 (B.T.E.). Mill Engineer, Castanea Paper Company, Lock Haven, Pa.

Parker, John George, Jr., IV, '31 (B.T.C.).

Parkin, Robert Wilson, VI, '27 (B.T.E.). Superintendent, Limerick Yarn Mills, Limerick Me.

Parkis, William Lawton, I, '09 (D). President and General Manager, Connecticut Cordage Company, North Oxford, Mass.

Parsons, Charles Sumner, VI, '27 (B.T.E.). With Hathaway Manufacturing Company, New Bedford, Mass.

Patsourakos, James Peter, IV, '39 (B.T.C.). With Pacific Mills, Lawrence, Mass.

Peabody, Roger Merrill, II, '16 (D). With Scovill Manufacturing Company, Waterbury, Mass.

Pearlstein, Maxwell, III, '28 (D). Proprietor, Abbotsford Pharmacy, Roxbury, Mass.

Pearson, Alfred Henry, IV, '11 (D). Salesman, Ciba Company, Inc., 157 Federal Street, Boston, Mass.

Peary, John Ervin, III, '31 (D). Designer, Berkshire Woolen Company, Pittsfield, Mass.

Pease, Chester Chapin, I, '09 (D). With Jackson Mills, Nashua, N. H.

Pease, Kilburn Gray, I, '38 (D). With Jackson Mills, Nashua, N. H.

Peck, Carroll Wilmot, IV, '13 (D). Vice-President, George Mann & Co., Inc., Providence, R. I.

Pelt, Joseph Paul, Jr., VI, '40 (B.T.E.). Production Manager, Groblue Sportswear, Newark, N. J.

Penney, Cabot William, III, '33 (D). Assistant Designer, Wyandotte Worsted Company, Pittsfield, Mass.

Pensel, George Robert, IV, '13 (B.T.D.). Vice-President, Ritter Chemical Company, Inc., Amsterdam, N. Y.

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Perlman, Samuel, IV, '17 (B.T.C.).

Perlmuter, Barney Harold, IV, '23 (B.T.C.). Treasurer, Mallon Mattress Company, Boston, Mass.

Pero, Richard Omer, II, '31 (D). Assistant Superintendent, Amos Abbott Company, Dexter, Me.

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Piligian, Hiag Nishan, IV, '32 (B.T.C.). Junior Inspector of Textiles, Quartermaster's Depot, Philadelphia, Pa.

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Pizzuto, Joseph James, Jr., IV, '33 (B.T.C.). Teacher, Textile High School, New York City.

Plaisted, Webster E., II, '18 (D). Superintendent of Woolens, Pacific Mills, (Worsted Division), Lawrence, Mass.

Ploubides, John Peter, IV, '38 (B.T.C.). Colorist, Pacific Mills, Worsted Division, Lawrence, Mass.

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Poremba, Leo Louis, IV, '35 (B.T.C.). Assistant Overseer, Dyehouse, Elm Woolen Mills, Tilton, N. H.

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Powers, Walter Wellington, IV, '20 (B.T.C.). Sales Department, Monsanto Chemical Company, Springfield, Mass.

Pradel, Alois Joseph, III, '00 (D). Designer, Killingly Worsted Company, Danielson, Conn.

Pradel, Mrs. Alois J. (Walker, Anna G.), IIIb, '03 (C). 78 Broad Street, Danielson, Conn.

Precourt, Joseph Octave, VI, '21 (B.T.E.). Vice-President, January & Wood Co., 222 West Adams Street, Chicago, Ill.

Prescott, Walker Flanders, IV, '09 (D). Manager, Prescott & Co., Reg'd, 774 Saint Paul Street, West, Montreal, Can.

Prescott, William Benjamin, IV, '39 (B.T.C.). Chemist, Calco Chemical Division, American Cyanamid Company, 35 Hartford Street, Boston, Mass.

Preston, Harold Lawrence, VI, '30 (B.T.E.). Sales Engineer, Chester C. Stewart Company, 8 Beacon St., Boston, Mass.

Prien, Walter Ferdinand, Lt. (SC) U.S.N., VI, '39 (M.S.). (B.S., U. S. Naval Academy, 1930.) Supply Officer, *U. S. S. Indianapolis*, Care of Fleet Post Office, Navy Yard, Pearl Harbor, T. H.

Putnam, George Ives, IV, '16 (B.T.D.).

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Radford, Garland, II, '20 (D). Vice-President, Oriental Textile Mills, Houston, Texas.

Ramsdell, Theodore Ellis, I, '02 (D). President, Monument Mills, Housatonic, Mass.

Rawlinson, Richard William, VI, '31 (B.T.E.). Assistant Advertising Manager, Whitin Machine Works, Whitinsville, Mass.

Ray, Lloyd Sanford, IV, '30 (B.T.C.). Chemist and Electro Plater, Excelsior Hardware Company, Stamford, Conn.

Raymond, Charles Abel, IV, '07 (D). Silviculturist, Essex, Mass.

Recher, Theodore, VI, '33 (B.T.E.). President and Treasurer, The Reclin Corporation, Milford, Mass.

Redding, Leslie Capron, II, '26 (D). Designer, Waucantuck Mills, Uxbridge, Mass.

Reddish, Charles Warren, IV, '38 (B.T.C.). Vice-President, W. C. Hardesty Company, Inc., Dover, Ohio.

Reddish, Warren Thomas, Jr., IV, '39 (B.T.C.). Proprietor, City Dye Works, Inc., 1159 State Street, Springfield, Mass.

Redmond, James Reynolds, IV, '36 (B.T.C.). Assistant Technologist, U. S. Quartermaster Corps, Jeffersonville, Ind.

Reed, Everett Carlton, VI, '39 (B.T.E.). Efficiency Rate Setting Work, Albany Felt Company, Albany, N. Y.

Reed, Harold Ernest, VI, '37 (B.T.E.). Principal, Schools of Textile Manufacturing and Designing, International Correspondence Schools, Scranton, Pa.

Reed, Norman Bagnell, I, '10 (D). Manager, Lowell Hosiery Mills, Inc., Lowell, Mass.

Reed, William Thorncroft, VI, '39 (B.T.E.). Warp Knitting Machine Fitter, Whitin Machine Works, Whitinsville, Mass.

Rees, Richard Holmes, I, '40 (D). Working Foreman, Charlton Woolen Company, Charlton City, Mass.

Regan, Paul William, IV, '37 (B.T.C.). Assistant Dyer, Crompton-Shenandoah Company, Waynesboro, Va.
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Reynolds, Fred Bartlett, II, '08 (D). Purchasing Agent, M. T. Stevens & Sons Company, North Andover, Mass.
Reynolds, Isabel Halliday, III, '03 (C). Clerk, Pacific Mills Print Works, Lawrence, Mass.
Reynolds, Raymond, II, '24 (D). Supervisor, DuPont Rayon Company, Buffalo, N. Y.
Rice, Josiah Alfred, Jr., III, '20 (D). Merchandise Manager, Marshall Field & Co., 200 Madison Avenue, New York City.
Rice, Kenneth Earl, VI, '29 (B.T.E.). With Sidney Blumenthal & Co., Shelton, Conn.
Rich, Edward, IV, '15 (B.T.D.). Manager, Jackson Caldwell Company, East Boston, Mass.
Rich, Everett Blaine, III, '11 (D). "Onacove," Sewall Road, Wolfeboro, N. H.
Rich, Milton Scott, II, '22 (D). Assistant Purchasing Agent, Harvard University, Cambridge, Mass.
Richardson, George Oliver, IV, '16 (B.T.D.). Manager, Special Products Division, National Aniline and Chemical Company, Inc., 40 Rector Street, New York City.
Richardson, Richardson Perry, I, '13 (D). New England Agent, Tamworth Associates, Inc., Needham Heights, Mass.
Riggs, Homer Chase, VI, '17 (B.T.E.). President, Riggs & Lombard, Inc., Lowell, Mass.
Ripley, George Keyes, II '17 (D). President, Troy Blanket Mills, Troy, N. H.
Ritchie, Newell Baird, IV, '40 (B.T.C.). Chemist, Wilton Woolen Company, Wilton, Me.
Rivers, William Anthony, II, '24 (D). Manager, Metropolitan Life Insurance Company, Marlboro, Mass.
Roarke, John James, IV, '36 (B.T.C.). Textile Chemist, Geigy Company, 88 Broad Street Boston, Mass.
Robbins, Lucy Wiley, VI, '37 (B.T.E.). See Weinbeck, Mrs. John C.
Robbins, Walter Archibald, VI, '30 (B.T.E.). Assistant to Plant Engineer, Columbia Mills, Inc., Minetto, N. Y.
Roberson, Pat Howell, I, '05 (C). Vice-President, Union State Bank, Pell City, Ala.
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Robillard, Gerald Adelbert, IV, '33 (B.T.C.). Chemist and Salesman-Demonstrator, Canadian Industries, Ltd., Montreal, Que.
Robinson, Ernest Warren, IV, '08 (D). Manager, Line Division, The Shakespeare Company, Kalamazoo, Mich.
Robinson, Russell, VI, '21 (B.T.E.). Overseer, Warwick Mills, West Warwick, R. I.
Robinson, William Albert, II, '25 (D). Author and Explorer, 16 Chauncy Street, Cambridge, Mass.
Robinson, William Carleton, III, '03 (C). With Durand Shoe Company, Auburn, Maine.
Robson, Frederick William Charles, IV, '10 (D).
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Ryan, David Louis, II, '27 (D). Sales Representative, Duplan Silk Corporation, 18 West Chelten Avenue, Philadelphia, Pa.
Ryan, Lawrence Francis, IV, '23 (B.T.C.). Chemist and Demonstrator, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
Ryan, Millard Kenneth Thomas, Jr., II, '24 (D). 320 Vernon Road, Germantown, Philadelphia, Pa.

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Sadler, Thomas Sheridan, II, '30 (D). With Carolina Asbestos Company, Davidson, N. C.

Sampson, Clifford William, IV, '28 (B.T.C.). Technical Director, Emery Industries, Inc., 4300 Carew Tower, Cincinnati, Ohio.

Sanborn, Frank Morrison, VI, '19 (B.T.E.). With Winnsboro Mills, Winnsboro, S. C.

Sanborn, Ralph Lyford, VI, '16 (B.T.E.). Purchasing Agent, Firestone Cotton Mills, Inc., Gastonia, N. C.

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Sargent, Robert Edward, IV, '25 (B.T.C.). Chemist, Tubize Chatillon Corporation, Rome, Ga.

Sargent, Walter Ambrose, I, '22 (D). Instructor, Textile Shop Practice, Board of Education, Passaic, N. J.

Saunders, Harold Fairbairn, IV, '09 (D). 301 West 8th St., Coffeville, Kans.

Savard, Aime Albert, Jr., IV, '33 (B.T.C.). Printing Department, United States Finishing Company, Norwich, Conn.

Savery, James Bryan, II, '23 (D). Treasurer, Savery Manufacturing Company, Hartford, Conn.

Sawyer, Henry Severance, VI, '32 (B.T.E.). Treasurer, Sawyer, Regan Company, Dalton, Mass.

Sawyer. Richard Morey, VI, '27 (B.T.E.). (M.S., 1929, Massachusetts Institute of Technology.) Office Manager, Firestone Cotton Mills, Inc., Gastonia, N. C.

Scanlon, Andrew Augustine, IV, '26 (B.T.C.).

Schaetzel, André Paul, IV, '21 (B.T.C.). Chief Chemist, Aspinook Corporation, Jewett City, Conn.

Schneiderman, Jacob, III, '27 (D). Golf Professional, Mt. Pleasant Country Club, Leicester, Mass.

Schoelzel, Herman Walter, IV, '35 (B.T.C.). With Ayer Mill, Lawrence, Mass.

Schreiter, Ehrich Ernest Max, VI, '26 (B.T.E.). Industrial Sales Representative, Sun Oil Company, Revere, Mass.

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Scott, Gordon Maxwell, IV, '20 (B.T.C.). Finisher, Princeton Worsted Mills, Inc., Trenton, N. J.

Shaber, Hyman Jesse, VI, '17 (B.T.E.). M.B.A., 1922 Harvard Graduate School of Business Administration). Shoe Buyer and Merchandiser, J. S. Raub Shoe Stores, Wilkesbarre, Pa.

Shah, Kantilal Hiralal, VI, '36 (B.T.E.). Bombay, India.

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Shapiro, Sidney, VI, '38 (B.T.E.). Textile Broker, Harry Strauss & Company, 66 Leonard Street, New York City.

Shapiro, Simon, VI, '34 (B.T.E.). Technical Assistant to President, Artcraft Silk Hosiery Mills, Philadelphia, Pa.

Shea, Francis James, II, '12 (D). 98 Pine Street, Florence, Mass.

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Shedd, Jackson Ambrose, III, '28 (D). Superintendent, S. Stroock & Co., Inc., Newburgh, N. Y.

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Shelton, Charles Leopold, VI, '29 (B.T.E.).

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Sjostrom, Carl Gustof Verner, Jr., III, '17 (D). Designer, Peerless Woolen Mills, Rossville, Ga.
Slamin, Alfred Francis, I, '26 (D). Sales Manager, Benjamin Franklin Paint and Varnish Company, Philadelphia, Pa.
Sleeper, Robert Reid, IV, '00 (D). Textile Chemist, Calco Chemical Division, American Cyanamid Company, Bound Brook, N. J
Smith, Allen Batterman, I, '26 (D). Turner Halsey Company, 40 Worth Street, New York City.
Smith, Doane White, II, '10 (D). 15 Oakland Street, Natick, Mass.
Smith, Frank Kenfield, II, '24 (D). Technician, Grout's, Ltd., St. Catharines, Ont.
Smith, Harold, IV, '34 (B.T.C.). 24 Belmont Street, Lowell, Mass.
Smith, Herbert Jeffers, VI, '22 (B.T.E.). Sales Representative, U. S. Ring Traveler Company, Providence, R. I.
Smith, Lawrence, Lt. (SC) U. S. N., VI, '40 (M.S.). (B.S., U. S. Naval Academy, 1932.) Naval Clothing Depot, Brooklyn, N. Y.
Smith, Ralston Fox, I, '04 (C). Sales Manager, W. H. Warner & Co., 1708 Union Trust Building, Cleveland, Ohio.
Smith, Roger Dennis, II, '27 (D). Assistant Superintendent, M. T. Stevens & Sons Co. (Pentucket Mills), Haverhill, Mass.
Smith, Theophilus Gilman, Jr., IV, '10 (D). Farming, Groton, Mass.
Snelling, Fred Newman, II, '03 (D). With the American Railway Express Company, Haverhill, Mass.
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Somers, Benjamin, II, '25 (D). 128 Pleasant Street, Brookline, Mass.
Sood, George David, IV, '38 (B.T.C.). Research Department, Slatersville Finishing Company, Slatersville, R. I.
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Spalding, Arthur Ovila, IV, '32 (B.T.C.). Technical Man on Wool and Worsted, Sandoz Chemical Works, Inc., New York City.
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Spevack, Edward, IV, '39 (B.T.C.). Chemist and Contact Man, Spevack-Garbaccio, Inc., East Rutherford, N. J.
Spiegel, Edward, II, '03 (C).
Stacey, Alfred Charles, IV, '30 (B.T.C.). Chemist & Dyer, Shoe Lace Company, Lawrence, Mass.
Standish, John Carver, IV, '11 (D). Superintendent, Albany Felt Company, Albany, N. Y.
Stanley, John Prince, Jr., IV, '29 (B.T.C.). Chemist, Mohawk Carpet Mills, Inc., Amsterdam, N. Y.
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Steele, Everette Vernon, IV, '24 (B.T.C.). In charge of Plexiglas Fabrication, Rohm & Haas Co., Inc., Philadelphia, Pa.
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Stevens, Raymond Russell, IV, '19 (B.T.C.). Chief Chemist, The Felters Company, Inc., Millbury, Mass.
Stevens, William Edwin, I, '34 (D). With B. B. & R. Knight Corporation, (Royal Mill), River Point, R. I.
Stevenson, Murray Reid, III, '03 (C).
Stewart, Alexander, VI, '31 (B.T.E.). U. S. Commissioner of Conciliation, U. S. Department of Labor, Washington, D. C.
Stewart, John Weeden, IV, '30 (B.T.C.). Laboratory Foreman, General Dyestuff Corporation, 435 Hudson Street, New York City.
Stewart, Walter Lawrence, III, '03 (D).

Stiegler, Harold Winfred, IV, '18 (B.T.C.). (M.S., 1922, Ph.D., 1924, Northwestern University.) Head of Textile Division, American Cyanamid Company, Stamford, Conn.

Stohn, Alexander Charles, III, '06 (C). Factory and Production Manager, Carl Stohn, Inc., East Taunton, Mass.

Stolzberg, Howard Nathaniel, IV, '35 (B.T.C.). Chemist and Owner, Jaybee Chemical Company, Haverhill, Mass.

Stone, Ira Aaron, IV, '09 (D). Vice-President, Royal Manufacturing Company, Charlotte, N. C.

Storer, Francis Everett, II, '07 (D). Meredith, N. H.

Storey, Alvin Briggs, VI, '28 (B.T.E.). Assistant Textile Superintendent, Celanese Corporation of America, Cumberland, Md.

Stott, John Smith, III, '28 (D). With Newmarket Manufacturing Company, Lowell, Mass.

Stowell, Eldon, A.B., I, '39 (D). Engineer, Sales Development Department, American Viscose Corporation, Marcus Hook, Pa.

Stronach, Irving Nichols, IV, '10 (D). Superintendent, Hampton Company, Easthampton, Mass.

Strout, Kenneth Edward, III, '28 (D). Designer, American Mills Company, New Haven, Conn.

Sturtevant, Albert William, IV, '17 (D). Foreman, Used Car Department, Lowell Motor Sales, Inc., Lowell, Mass.

Sturtevant, Fred William, IV, '26 (B.T.C.). Chemist, Naugatuck Chemical Division, United States Rubber Products, Inc., Naugatuck, Conn.

Suhlke, Waldo Eric, IV, '20 (B.T.C.). Teacher, Jefferson Junior High School, Meriden, Conn.

Sullivan, John David, VI, '12 (D). With Robert Gair Company, Bradford, Mass.

Sullivan, Lambert William, II, '23 (D). Instructor in Textiles, Massachusetts Reformatory, West Concord, Mass.

Sullivan, Willard David, II, '23 (D). Breene's Store, Lowell, Mass.

Sunbury, Herbert Ellsworth, VI, '18 (B.T.E.). Works Manager, Asbestos Textile Company, Inc., North Brookfield, Mass.

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Sutcliffe, Henry Mundell, II, '25 (D). Second Hand, Webster Mills, Webster, Mass.

Sutton, Leslie Emans, I, '17 (D). Manager, Anniston Cordage Company, Anniston, Ala.

Swain, Harry LeRoy, Jr., I, '26 (D). Purchasing Department, Firestone Tire & Rubber Co., Akron, Ohio.

Swan, Guy Carleton, II, '06 (D). Chemist, Federal Security Agency, 201 Varick Street, New York City.

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Sweatt, Safford Pershing, IV, '40 (B.T.C.). Textile Chemist, Ciba Company, Inc., New York City.

Sweeney, George Hamilton, II, '24 (D). Salesman, Walker Stetson Company, 147 Essex Street, Boston, Mass.

Swiatek, Bronislaw John, VI, '40 (M.S.). (B.S., Tri-State College, 1938.) Physical Testing, Morse Twist Drill & Machine Co., New Bedford, Mass.

Swift, Edward Spooner, S. J., I, '02 (D). Clergyman, Church of the Immaculate Conception, Boston, Mass.

Syme, James Francis, II, '00 (D). Vice-President and Director, Hayward-Schuster group of mills, East Douglas, Mass.

Symmes, Dean Whiting, IV, '22 (B.T.C.). Salesman and Demonstrator, National Aniline and Chemical Company, 150 Causeway Street, Boston, Mass.

Tamulonis, Edward William, VI, '30 (B.T.E.). In charge of Production and Scheduling, Newmarket Manufacturing Company, Lowell, Mass.

Tang, Hsiung-Yuan, I, '30 (D).

Tarpey, Thomas Joseph, IV, '27 (B.T.C.). 23 Fremont Street, Somerville, Mass.

Tarshis, Elias Aaron, IV, '28 (B.T.C.).

Teague, Charles Baird, II, '26 (D). Civil Engineer, Highway Division, Massachusetts Public Works Department, Boston, Mass.

Thaxter, Joseph Blake, Jr., II, '12 (D). Sales Executive, Ludlow Manufacturing & Sales Corporation, 211 Congress Street, Boston, Mass.

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Thomas, Benjamin, Jr., VI, '34 (B.T.E.). Overseer, Jackson Mills, Nashua, N. H.

Thomas, Henry Edward, VI, '40 (B.T.E.). 41 Bellevue Street, Lowell, Mass.
Thomas, Robert Joseph, IV, '34 (B.T.C.). (M.S., 1937, Ph.D., 1939, University of Notre Dame). Research Chemist and Colorist, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del.
Thomas, Roland Vincent, I, '05 (C). With Chicopee Sales Corporation, 40 Worth Street, New York City.
Thompson, Arthur Robert, Jr., IV, '22 (B.T.C.). Salesman, Ciba Company, Inc. Charlotte, N. C.
Thompson, Everett Leander, I, '05 (D). 53 Morse Avenue, Brockton, Mass.
Thompson, George Robert, IV, '35 (B.T.C.). Chemist, United States Finishing Company, Norwich, Conn.
Todd, Walter Ernest, III, '23 (D). Resident Agent, Metropolitan Life Insurance Company, Uxbridge, Mass.
Toepler, Carl, IV, '22 (B.T.C.). Superintendent of Permanent Finishing, Bellman Brook Bleachery Company, Fairview, N. J.
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Toshach, Reginald Alexander, II, '11 (D). Proprietor, Toshach's Mill Remnants; Haverhill, Mass.
Toupin, Stephane Frederick, VI, '24 (B.T.E.). Plant Engineer, Regent Knitting Mills, Ltd., St. Jerome, Quebec.
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Tyler, Lauriston Whitcombe, II, '16 (D). Manager, W. T. Grant Company, Brunswick, Me.

Valentine, Burnet, VI, '23 (B.T.E.). Department Manager, Pepperell Manufacturing Company, 40 Worth Street, New York City.
Valentine, Preston Sumner, IV, '36 (B.T.C.). With American Seal-Kap Corporation, Long Island City, N. Y.
Valvanis, Nicholas John, IV, '40 (M.S.). (B.S., Massachusetts State College, 1939.) With A. M. Tenney Associates, Inc., New York City.
Vaniotis, Socrates Vasilios, IV, '37 (B.T.C.). Shelton Looms, Shelton, Conn.
Varnum, Arthur Clayton, II, '06 (D). South Lyndeboro, N. H.
Villa, Luis Jorge, IV, '25 (B.T.C.). With Fabrica de Hilados y Tejidos del Hato, Medellin, Colombia, S. A.
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Vincent, William Henry, III, '26 (D). 18 Albion Street, Hyde Park, Mass.

Wagner, George Frederic, Jr., VI, '38 (B.T.E.). Assistant Superintendent, Oxford Looms, Inc., Oxford, Mass.
Walen, Ernest Dean, VI, '14 (B.T.E.). General Manager, Pacific Mills (Worsted Division), Lawrence, Mass.
Walker, Alfred Schuyler, II, '11 (D). 67 Park Avenue, Saranac Lake, N. Y.
Walker, Anna Gertrude, IIIb, '03 (C). See Pradel, Mrs. Alois J.
Walker, Raymond Scott, II, '23 (D). Production Superintendent, Arlington Mills, Lawrence, Mass.
Walker, Samuel J., IV, '32 (B.T.C.). Analyst, National Association of Dyers and Cleaners, Silver Springs, Md.
Wallace, Joseph Max, IV, '31 (B.T.C.). With Enequist Chemical Company 255 Freeman Street, Brooklyn, N. Y.
Wang, Chen, IV, '23 (B.T.C.).
Wang, Cho, VI, '23 (B.T.E.).
Wang, Tung Chuan, VI, '23 (B.T.E.).
Wang, Yun-Cheng, VI, '31 (B.T.E.). Assistant Manager, Sung Sing Cotton Mill No. 1, Shanghai, China.
Wang, Yung Chi, II, '21 (D).
Ward, George Chester, IV, '28 (B.T.C.). Research Chemist, Celanese Corporation of America, Cumberland, Md.
Warren, E. Maybelle, IV, '28 (B.T.C.). Chemist, Hub Hosiery Mills, Lowell, Mass.
Warren, Philip Hamilton, II, '05 (D). Superintendent, Hopeville Manufacturing Company, Worcester, Mass.

Washburn, John Milton, Jr., IV, '21 (B.T.C.). Salesman, Colgate-Palmolive-Peet Company, Boston, Mass.

Watson, William, III, '11 (D). Real Estate, Wm. Watson, 50–54 Merrimack Street, Haverhill, Mass.

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Weinbeck, Mrs. John C. (Robbins, Lucy W.), VI, '37 (B.T.E.). 102 South Loring Street, Lowell, Mass.

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Welch, William Paul, Jr., IV, '36 (B.T.C.). Insurance Agent, Boston Mutual Life Insurance Company, Lowell, Mass.

Wells, Ai Edwin, VI, '20 (B.T.E.). (Ed.M. 1937, Boston University.) Assistant Professor, Textile Engineering Department, Lowell Textile Institute, Lowell, Mass.

Wells, Henry Alfred, Jr., IV, '33 (B.T.C.). Night Overseer of Printing, Ware Shoals Manufacturing Company, Inc., Ware Shoals, S. C.

Westaway, John Chester, VI, '28 (B.T.E.). Secretary-Treasurer, W. J. Westaway Co., Ltd., Hamilton, Ont., and Vice-President, Sonoco Products Company of Canada, Ltd., Brantford, Ont.

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Wetherbee, Francis Putney, I, '28 (D). Flint River Cotton Mills, Albany, Ga.

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Whitcomb, Roscoe Myron, IV, '10 (D). Pharmacist, R. M. Whitcomb, Ashland, N. H.

White, Royal Philip, II, '04 (D). Resident Manager, American Woolen Company (Vassalboro Mills), North Vassalboro, Me.

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Williams, Albert William, III, '32 (D). Designer, Manhattan Shirt Company, New York, N. Y.

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Wilman, Rodney Bernhardt, II, '25 (D). Superintendent, New England Fibre Blanket Company, Worcester, Mass.

Wilson, Raymond Bachman, II, '36 (D). With International Narrow Fabric Company, Keene, N. H.

Wing, Charles True, III, '02 (D). Paymaster, M. T. Stevens & Sons Company, Dracut, Mass.

Wingate, William Henry, IV, '08 (D). Superintendent, Hodges Finishing Company, Dedham, Mass.

Winkler, Burton Cole, IV, '39 (B.T.C.). Dyer, U. S. Finishing Company, Sterling, Conn.

Wise, Paul Tower, II, '01 (D). President, Chelsea Fibre Mills, 1155 Manhattan Avenue, Brooklyn, N. Y.

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Woo, Tsunkwei, VI, '19 (B.T.E.).

Wood, Ernest Hadley, S. B., IV, '11 (D).

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Woodcock, Eugene Close, II, '07 (D). Manager, Jute Yarn Department, Ensign Bickford Company, Simsbury, Conn.
Woodhead, Joseph Arthur, VI, '23 (B.T.E.). Textile Engineer, Research and Development Department, Colgate-Palmolive-Peet Company, Jersey City, N. J.
Woodies, Ida Alberta. IIIb, '00 (C). See Shananquet, Mrs. Lee.
Woodman, Harry Lincoln, I, '02 (C). Cost Accountant, Monsanto Chemical Company, Merrimack Division, Everett, Mass.
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DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

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CALENDAR—1941

September 25, Thursday	Registration
October 2, Thursday	Registration
October 6, Monday	Opening of evening school
October 13, Monday	Holiday—Observance of Columbus Day
November 11, Tuesday	Armistice Day—Holiday
November 27–28, Thursday and Friday	Thanksgiving Recess. No classes
December 19, Friday	End of first term
1942	
January 5, Monday	Opening of second term
March 6, Friday	Closing of evening school
April 9, Thursday	Graduation

GENERAL INFORMATION.

Entrance Requirements

All applicants to the evening classes must understand the English language and simple arithmetic. Those who are graduates of a grammar or high school are admitted upon certificate. Those who cannot present such a certificate are required to take examination in the subjects of English and arithmetic. In the examination in English a short composition must be written on a given theme, and a certain amount must be written from dictation. In the examination in arithmetic the applicant must show suitable proficiency in addition, subtraction, multiplication, division, common and decimal fractions, percentage, ratio and proportion. Opportunity to register or to take these examinations is offered each year, generally on the Thursday evenings of the two weeks previous to the opening of the evening school.

Registration

Before entering the class a student must fill out an attendance card, which can be obtained at the office or from the instructors in the various departments.

Any student who has filed an attendance card and who wishes to change his course must notify the office before making the change.

Sessions.

The evening classes commence the first Monday of October and continue for twenty weeks. The school is open on four evenings each week during the period mentioned, except when the school is closed for holiday recesses.

Supplies.

Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause.

Students' supplies will be sold from the co-operative store every evening school night from 6.45 to 8.15 P.M.

Fees and Deposits.

All evening courses are free to residents of Lowell. To those outside of Lowell the fee is $10 per year for *each course of two nights per week.* Students taking two courses or attending courses requiring more than two nights per week are required to pay $15 per year for three nights and $20 for four nights.

All fees and deposits must be paid in advance.

All students, whether from Lowell or not, taking Course 411, Chemistry and Dyeing Department, are required to make a deposit at the commencement of the course—$5 for first-year students, and $10 for second-year students. A deposit of $10 will be required of all students taking Course 412, 413 or 414. This is to cover the cost of laboratory breakages, chemicals, apparatus, etc., and at the end of the year any unexpended balance is returned, or an extra charge made for the excess breakage.

All students taking Machine-Shop Practice will be required to make a deposit of $5. Any unexpended balance remaining at the end of the year will be returned to the student.

Report of Standing.

A report of standing covering the year's work is sent to all students who attend the entire year and take the necessary examinations.

Certificates.

The courses of the evening school are varied and arranged to meet the special needs of those engaged in the industry. They vary in length from one to four years, and at the completion of each course the certificate of the school is awarded, provided, however, that the student has been in attendance in the course during the year for which the certificate is granted.

GENERAL EVENING COURSES

The object of these courses is to give young men of ambition an opportunity to obtain instruction in all the branches of science that are allied with their daily work. For example, one who is employed as a weaver in a textile mill may obtain

knowledge of the manufacture of yarn, the production of a design, and the methods of finishing a fabric, as well as the manner of its weaving or knitting. In like manner the dyer may augment his knowledge of the chemicals and materials he is daily handling. The engineer and machinist may acquire a knowledge of the mathematics, science of mechanics, electricity and drawing that underlie all the work of an engineer.

It is recognized that the interests of such students lie in a particular field of industry, and these courses are designed to bear directly upon the special line, and supplement, as far as possible, the practical work in which the student is engaged during the day.

In a word, any man having a common school education and the ambition to advance in his line may now secure a broad and comprehensive training in the subjects which will be of vital importance to him in obtaining the goal of his ideal.

A description of all courses follows.

COTTON DEPARTMENT.

The courses offered in the Cotton Department are intended for those interested in cotton yarn manufacture and sales. In addition to the value for those directly connected with the carding and spinning departments, the courses offer an opportunity for students who are working in the mill office or the selling office. Men selling supplies to cotton mills will find in these courses an opportunity to become acquainted with the business and its problems which will make possible a more complete service to their customers.

111. Cotton Yarns—2 Years.

The *first year* work in cotton yarn manufacture includes a study of cotton and its preparation for market, followed by a study of opening, picking, carding and combing. This work consists of lectures on these operations combined with problems that are peculiar to each operation such as the drafts used, the production of each process and the amounts of waste made. Special consideration is given to the adjustment and care of these machines and some laboratory demonstration is used to show the manner of adjusting machines for the purpose of controlling the weight of the product, the amount of work done in a day and the amount of waste made.

Two evenings each week.

Cotton.—This course starts with a study of cotton growing, the areas producing cotton and the characteristics of cottons from the various producing areas. The effects of seed selection, cultivation, and weather conditions on the cotton are emphasized.

Picking and ginning of cotton are studied to show the importance of proper preparation of lint for mill consumption.

There is a general survey of the intricate cotton marketing system, illustrating the methods of specifying cotton desired and securing delivery at a known price.

Opening and Picking.—As this equipment has changed considerably in recent years, special notes are used illustrating modern machinery and its arrangement. Machine parts, construction and adjustment, are discussed in the classroom and demonstrated in the laboratory. Mixing of cottons for colored work or for price control is considered under these processes.

Carding.—The process of carding is considered one of the most important, and proper time is devoted to the construction and operation of cards that the student may be familiar with the various parts of the card and the function and design of each. The construction and application of card clothing, and the methods of grinding form a part of the work. Some time is given to a discussion of the waste made in carding, the regulation of the amounts of each made and the calculation of the percentages. New and special attachments for various purposes are brought to the attention of the class, illustrating possible ways of improving carding conditions.

Combing.—The preparation of card sliver for combing by means of the sliver lapper and ribbon lapper is thoroughly considered. The combing operation itself is studied in considerable detail, emphasizing the general object and operations in combing and the specific means employed by various types of combs in performing the operations. The calculations in this connection involve the drafts and doub-

lings necessary to produce the proper lap for the comb, the proper comb drafts, and the determination of the per cent of noil produced.

The *second year* work in cotton yarn manufacture includes a study of the operations of drawing, roving, spinning, winding and twisting. The work consists largely of lectures and problems with some laboratory demonstrations to make the student familiar with the machines and the points of adjustment.

Two evenings each week.

Drawing.—The instruction on drawing introduces the principles of roller draft and the theory of doublings. Special attention is given to roll covering materials and their application. The measurement of uniformity of slivers by various methods is considered here.

Roving.—Roving includes the various machines known as the slubber, intermediate, fine and jack fly frames. Each of the various motions of these complicated machines is treated separately and then the group is taken as a unit, tying each operation in with the others. Particular attention is paid to the subjects of lay and tension because of their importance in producing perfect roving. The calculations in this subject involve draft, twist, lay and tension with particular attention to the derivation of constants and their use. The new systems of long draft for roving frames are included in this work.

Ring Spinning.—A study of the various types of yarns gives the student an appreciation of the necessary characteristics for various purposes and how these may be obtained. Standard draft and long draft systems are studied in detail. Important machine parts, such as rings, builders, guides and travelers, their adjustment and care, form an important part of this subject. Yarn faults and defects are shown and their causes explained.

Spooling and Winding.—The discussions under this head cover the treatment of single yarns in preparation for twisting, comparing the relative merits of spooling with multiple winding on tubes, and beaming for special twisters. Winders are also considered as a means of preparing yarn packages for sale yarns.

Twisting.—Because of the similarity to ring spinning, the emphasis here is more on the manufacturing part of the work, although there are a few peculiar features of a mechanical nature. The twisting of various regular ply yarns, the making of numerous fancy yarns and the principles underlying the production of various patterns are taken up. The use of special twisters and other apparatus for cords and ropes is considered under this heading.

113. Knitting—1 Year.

This is a general course on the manufacture of knitted fabrics and garments, intended for those interested in the principles of knitting and a study of the mechanisms of a variety of knitting machines. The more important phases of the course are:—

Yarns and Yarn Sizing Systems.—In order that the student may understand the distinctions between yarns, terminology, and the various sizing systems commonly used, several lectures are devoted to yarn characteristics and sizing as a basis for the entire course. This covers cottons, woolens, worsteds, silks and rayons.

Flat Machines.—These relatively simple machines make a fine starting point in establishing clearly the action of the latch needle and how it is operated. Lamb, Dubied, Grosser, and Links and Links machines are used as a basis for this part of the work.

Small Circular Ribbers.—These machines are a very logical step, following flat machines. Brinton, Wildman, and Universal ribbers, with different pattern mechanisms, are used in illustrating this type of work.

Automatic Hosiery Machines.—This section of the course is built around the various Banner and the Scott and Williams half and full hose machines. Most of the work is done with the plain machines as there is not sufficient time to include the fancy pattern type.

Large Ribbers and Spring Needle Machines.—Underwear fabric and webbing are produced on this type of equipment. Scott and Williams, Wildman and Crane machines are the basis for instruction along these lines.

Full Fashioned Machine.—A brief study of the full fashioned principles and actions is based on the Reading 18-section machine in the laboratory.

Warp Knitting.—Using the Raschel machine in the laboratory, a general study of warp knitting includes Tricot and Milanese work also.

Analysis.—During the study of the various machines, considerable attention is given to the many "stitches" possible. This, coupled with the lectures on fabric and hosiery analysis, covers the common analysis problems.

Routines.—The usual sequence of manufacturing processes for hosiery and underwear are studied with the idea of illustrating the steps necessary in producing different articles.

Most of the instruction in this course is given by lectures. As many of these machines are small, it is common practice to bring the machine under discussion into the classroom so that students may see the machine and parts being considered. In other instances, the class may go into the laboratory to see the equipment and its operation.

114. Cotton Organization—1 Year.

This course, offered only to those who have completed the work in Carding and Spinning, is a study of the common arrangements of drafts, sizes and production details for manufacturing various cotton yarns. Illustrative problems demonstrate how to provide for "balancing" a mill or how to divide equipment to produce different yarns in given quantities.

Some time is devoted to discussing various common machinery layouts and the number of operatives required for certain manufacturing arrangements. Typical mill job analysis problems involving time study and end breakage tests are considered.

Two evenings each week.

WOOLEN AND WORSTED DEPARTMENT.

211. Woolen Yarns—1 Year.

Instruction consists of lectures on technology of wool fiber (for detailed description see Course 217) and woolen yarn manufacture. This covers all the operations in detail necessary to manufacture yarns from raw stock on the woolen principle, and includes lectures and laboratory work on burr picking, wool blending, mixing, picking, wool oils and emulsions, carding, spinning on both mule and ring frame, and plain and novelty twisting.

Reworked fiber (shoddy) is covered in detail from rag sorting to finished staple.

Three evenings each week.

217. Wool and Top Making—1 Year.

Instruction consists of lectures in technology of wool fibers, worsted carding and combing, and mechanism and calculations.

Technology of Wool Fibres—*one evening each week.*

Raw Materials.—The study of raw materials which enter into the manufacture of woolen or worsted yarns or hardened felts, or are made into yarns by processes similar to those employed in the manufacture of woolen and worsted yarns, includes silk, mohair, alpaca, vicuna, cashmere, camel hair, cut staple rayon, etc. In connection with these are considered shoddy, noils, and extracts.

Wool Sorting.—Familiarity with the various grades and kinds of wool is obtained by lectures. The various characteristics and properties are explained, as are also trade terms, such as Fine, ½-blood, ⅜-blood, 56^s, 36^s, B super, delaine, braid, etc. Over 1,500 samples of wool and other fibers gathered from all the countries of the world are catalogued and are available for inspection and study. Wool shrinkages are studied as are also spinning qualities. A complete collection of literature pertaining to sheep, wool, etc. is available for outside reading or study.

Wool Scouring.—The objects of scouring or degreasing and the methods employed are explained. This involves the consideration of soaps and chemicals used in scouring and degreasing, also the waste products and their utilization. A sorted lot of grease wool is scoured by machines that are made similar in operation to regular commercial wool scouring machines. At the same time the use of driers, their operation and regulation, is taken up.

Carbonizing.—The methods of carbonizing wool, noils, burr waste, rags, etc. are studied. If time permits, a commercial quantity of stock is carbonized on the regulation carbonizing machines in the wool laboratory.

Worsted Carding and Combing—*one evening each week.*

Carding.—The different types of worsted cards are studied in detail, as well as the construction, setting and operation of cards. A part of this work consists of a study of card clothing, its construction, application, grinding, setting, etc.

Combing.—This branch takes up the preparing processes, backwashing, also gilling of the stock before and after combing. The construction of the gill boxes and Noble comb is studied by lectures. Two Noble combs are available for inspection and study.

Mechanism and Calculations—*one evening each week.*

This subject gives the principles of the various mechanisms used in wool manufacturing machines. Among the topics dealt with are—equations, surface speed, R. P. M., drivers, drivens, draft and production calculations, stop motions, combing layouts, levers, logarithms, top testing, calculations, etc.

218. Worsted Yarns—1 Year.

Instruction is devoted to detail study of the English and French systems of worsted yarn manufacture.

The French comb is studied, and the various calculations to determine draft, noiling, productions, etc., are made.

Drawing and Spinning.—The equipment in the laboratory offers opportunity to make worsted yarn by either the Bradford or open drawing system or by the French system. The process includes the various machines in the successive steps of making Bradford spun yarn, and the functions of the different machines are studied. In the latter, or French system, the stock is run through the drawing machines, and the roving spun into yarn on the worsted mule or frame. The same method of studying the mechanism and operations of these machines is followed as in the case of previous methods of instruction. The student by pursuing this course can compare the different methods of yarn manufacture and note the results of each.

With the instruction in spinning by the Bradford system is given work on the twisters and the effects that may be produced.

Three evenings each week.

TEXTILE DESIGN AND WEAVING DEPARTMENT.

311. Cotton Design—3 Years.

During the *first year* instruction is given in elementary designing, starting with all the foundation weaves which may be used in fabrics such as the plain weave, rib weaves, basket weaves, twill weaves, satin weaves, granite weaves, etc. Combination and derivative weaves are made up from the aforesaid weaves. Fancy and figured weaves, in most cases originated by the student, are produced. Color effects, which are so essential in fabrics, obtainable from the different weaves, as stated above, in which the color arrangement of warp and filling create the pattern, are thoroughly considered. Not only the designing, but also harness drafting and the making of dobby chains for all type of weave is taken up.

Cloth analysis is considered in conjunction with designing, as a designer must know the kind of fabric he is designing, what material and what size of yarns are to be used, and how heavy and costly the cloth is to be: The various topics discussed are the sizes or counts of yarns made from all kinds of fibers, such as cotton, woolen, worsted, silk, rayon, jute and yarns of other vegetable fibers. Their relative length to the pound is determined in the single two or more ply, mixed yarns, novelty yarns and fancy yarns, in the American or English system. The same is given in the metric system. Problems involving the take-up of yarns in the weaving and finishing process are given. Samples of cloth are picked apart to determine their weaves and general construction.

Two evenings each week.

In the *second year* cloth analysis and design are combined in lecture and practice, starting with plain and leading into the more fancy cotton dobby fabrics. A great variety of samples of cloth are used in class work to determine ends and picks per inch, shrinkage in warp and filling, and the number of reed and reed widths necessary for eventual reconstruction. The yarn numbers of warp and filling are determined

by aid of fine balances. The amount of warp and filling necessary for a piece of goods is calculated and the weight of a whole piece as well as the number of yards per pound are determined.

Two evenings each week.

In the *third year* more elaborate cloths are considered, both in designing and analysis, cloths in which extra warp or extra filling, or both, are used. Warp backed, filling backed, double, triple or more plied fabrics are taken up, such as marseilles, quilting, pique, suspenders, narrow webbings, velveteens, fancy velveteens, velvets, corduroys, Bedford cords, plushes, leno, in fact, anything a student may suggest which might help him in his work.

Two evenings each week.

312. Woolen and Worsted Design—3 Years.

This course covers the design and analysis of standard woolen and worsted fabrics and is intended for those who wish to specialize in this branch of textile fabric manufacture. Special and fancy fabrics are studied to the extent that time will permit.

During the *first year* instruction is given in the subject of classification of fabrics, use of points or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks and stripes, fancy weaves, including figured and colored effects; producing chain and draw from design, and *vice versa*; extending and extracting weaves.

The analysis of samples is taken up in a systematic manner, illustrating the various cloth constructions for the purpose of determining the design of the weaves and the amount and kind of yarns used, and forms the basis of calculation in the cost of reproducing any style of goods. The various topics discussed are reeds and setts; relation and determination of counts of cotton, woolen, worsted, silk and yarns made from the great variety of vegetable fibers; grading of yarns, folded, ply, novelty and fancy yarns; application of the metric system to yarn calculation; problems involving take-up, average counts, determination of counts of yarn, and weight of yarn required to produce a given fabric.

Two evenings each week.

During the *second year* instruction is given in cotton warp goods, blankets, bath robes, filling reversible, extra warp and filling backs, figured effects produced by extra warp and filling, double cloths and plaid backs.

The analysis work follows as closely as possible the type of fabrics taken up in the designing and the reconstruction of these fabrics with the consideration of their shrinkage and composition.

Two evenings each week.

In the *third year* instruction is given in multiple fabrics, chinchilla, Bedford cords, crepon, matelasse and imitations, double plains, meltons, kersey, plush and suitings. At this time also is taken up the construction of designers' blankets, suggestion cards, and the construction of samples.

The construction of new fabrics from theoretical viewpoint together with the construction from suggestion cards is taken up. In connection with this work instruction is given in making cost estimates for both woolen and worsted fabrics.

Two evenings each week.

313. Decorative Art—3 Years.

The first year work consists of charcoal drawing from plaster models and group arrangements of still life for ten weeks. The second ten weeks deals with pastel drawing of still life groups.

Two evenings each week.

During the second year instruction is given in color harmony—a study of color and variety of effects obtainable.

Two evenings each week.

In the third year the student chooses one of the following options:

1. Life Drawing—drawing from model.
2. Painting—either in oils or water color of still life groups.
3. Perspective—a study of the mechanical approach to correct drawing.

Two evenings each week.

314. Show Card Design—2 Years.

Lettering.—During the *first year* the student is taught to master the drawing, with pencil, of a few very plain alphabets, both upper and lower case letters, also plain figures. With the characteristics of plain letter alphabets well in mind, it is but a few steps to make any of the more intricate ones. Following this he will make simple "lay-outs" of plain card signs, and then take up the lettering, with brush and paint, of some of his simple card designs.

Two evenings each week.

The *second year* is simply a continuation of the latter part of the first year work, with the addition of advanced design in the "lay-out" and color-scheme of practical show cards and posters, such as are designed and lettered in the up-to-date Show Card Shop of to-day.

Two evenings each week.

321. Cotton Weaving—1 Year.

The Course in Cotton Weaving covers instruction on plain looms, Draper Automatic and Stafford Automatic looms. It includes instruction on the construction of shedding and picking motions, take-up and let-off motions together with the operation of the magazines and hoppers and methods of changing shuttle and bobbin. A study is also made of the preparation of warps, beaming, sizing and drawing-in. The Crompton and Knowles Automatic Towel Looms, and the various types of box looms, including chain building and work on multipliers, are also considered in this course.

Two evenings each week.

322. Woolen and Worsted Weaving—1 Year.

This course includes instruction on the Crompton and Knowles loom and takes up general construction, head motions, take-up, let-off, filling stop motion, etc. The preparation of warps, wet and dry dressing, is given in connection with this course.

Two evenings each week.

324. Loom Fixing—1 Year.

The course in Loom Fixing takes up the timing of all the different motions in the loom, such as the shedding, picking, and adjustment of the shuttle boxes on the 4 x 4 Crompton & Knowles and Draper box and automatic looms, and the setting for the Baker shuttle changing mechanism.

In addition there are many trouble hints given and the various remedies for improper setting. Box chain and harness chain planning and building is also taken up.

Two evenings each week.

CHEMISTRY AND DYEING DEPARTMENT.

Hardly any branch of applied science plays so important a part in our industrial world as chemistry. Many large mills employ chemists as well as dyers, and with the great progress which is being made in the manufacture and application of dyestuffs, a basic knowledge of chemistry becomes an absolute necessity to the dyer. Within a comparatively short distance from Lowell are establishments employing men who require some knowledge of chemistry but who may not necessarily use dyes. Some find a knowledge of analytical chemistry helpful in their everyday work.

To meet these varying needs of our industrial community, the school offers a two-year course in general chemistry, organic and inorganic, which may be followed by any one of three courses, viz., textile chemistry and dyeing, analytical chemistry, and textile and analytical chemistry. In order to take Course 412, 413 or 414, candidates must have a certificate from Course 411, or show by examination or approved credentials that they have taken the equivalent of the work covered by this course.

411. Elementary Chemistry—2 Years.

General Chemistry, including Inorganic and Organic.
Qualitative Analysis.

One lecture and one Laboratory Period per week in General Chemistry the first year, continued three nights a week during the second year, when the Elementary Organic Chemistry and Qualitative Analysis is completed.

Instruction in Elementary Chemistry extends through two years, and includes lectures, recitations and a large amount of individual laboratory work upon the following subjects:—

THEORETICAL CHEMISTRY.—Chemical action, chemical combination, combining weights, atomic weights, chemical equations, acids, bases, salts, Avogadro's law, molecular weights, formulæ valence, periodic law, etc.

NON-METALLIC ELEMENTS.—Study of their occurrence, properties, preparation, chemical compounds, etc.

METALLIC ELEMENTS.—Study of their occurrence, properties, metallurgy, chemical compounds, etc.

The students take up, as thoroughly as time will permit, the qualitative detection of the more common metals and non-metals, with practical work.

This work, although necessarily elementary, is intended to prepare the student to study more understandingly the manufacture of dyestuffs and coal tar colors in the more advanced courses which follow.

During the *first year* of the Elementary Chemistry course most of the time is devoted to the non-metals and theoretical chemistry, and the laboratory work covers briefly the non-metals.

Two evenings each week.

During the *second year* the classroom work is upon metals and the hydrocarbons and their derivatives, and the laboratory work consists entirely of Qualitative Analysis. While this course is necessarily taken up in an abbreviated and elementary manner, it is so arranged that the students may become familiar with the separations and the detections of the common metals and acids. This course is also preliminary to the work given in Analytical Chemistry.

Three evenings each week.

412. Textile Chemistry and Dyeing—3 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Dyeing.

Covered by 60 lectures and two nights of laboratory work per week.

The outline of the lecture course given in Textile Chemistry and Dyeing is as follows:—

TECHNOLOGY OF VEGETABLE FIBERS.—Cotton, linen, jute, hemp, china grass. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

TECHNOLOGY OF ANIMAL FIBERS.—Wool, mohair, silk. Chemical and physical properties, chemical compositions, microscopical study, and their action with chemicals, acids, alkalies and heat.

TECHNOLOGY OF ARTIFICIAL FIBERS.—Study of the various forms of artificial silk, the process of manufacture, their properties and action with chemicals, acids and heat.

OPERATIONS PRELIMINARY TO DYEING.—Bleaching of cotton and linen; wool-scouring; bleaching, fulling and felting of wool; carbonizing; silk-scouring and bleaching, action of soap.

The bleaching of cotton is studied with description of the various forms of kiers and machinery used; also the action of the chemicals used upon the material, and the various precautions that must be taken in order to insure successful work.

Under this heading is included a study of the reagents used in the emulsive wool-scouring process, and their action upon the fiber under various conditions; also the most successful of the solvent methods of degreasing wool.

WATER AND ITS APPLICATION IN THE TEXTILE INDUSTRY.—Impurities present, methods of detection, their effect during the different operations of bleaching, scouring, dyeing and printing, and the methods used for their removal or correction.

The important subject of boiler waters is also studied under this heading, with a full discussion of the formation of boiler scale, its disastrous results, and the methods by which it may be prevented.

Mordants and Other Chemical Compounds used in Textile Coloring, and Classified as Dyestuffs.—Theory of mordants, their chemical properties and application, aluminum mordants, iron mordants, tin mordants, chromium mordants, organic mordants, tannin materials, soluble oil, fixing agents, leveling agents, assistants, and numerous other compounds not dyestuffs that are extensively used in the textile industry.

Under this heading are included the definitions of various terms and classes of compounds used by textile colorists, such as color lakes, pigments, fixing agents, developing agents, mordanting principles and leveling agents.

Natural Organic Coloring Matters.—Properties and application of indigo, logwood, catechu or cutch, Brazil wood, cochineal, fustic, tumeric, madder, quercitron bark, Persian berries, and other natural dyestuffs that have been used in recent years by textile colorists.

Mineral Coloring Matters.—Under this heading are discussed the properties of such inorganic coloring matters and pigments as chrome yellow, orange and green, Prussian blue, manganese brown, iron buff.

Artificial Coloring Matters.—General discussion of their history, nature, source, methods of manufacture, methods of classification and their application to all fibers.

Besides lectures and recitations upon the subject of Textile Chemistry and Dyeing, practical laboratory work is required. By the performance of careful and systematic experiments the student learns the nature of the various dyestuffs and mordants, their coloring properties, their action under various circumstances, and the conditions under which they give the best results. The more representative dyestuffs of each class are applied to cotton, wool and silk, and each student is obliged to enter, in an especially arranged sample book, a specimen of each of his dye trials with full particulars as to the conditions of experiment, percentage of compounds used, time, temperature of dye baths, etc.

For convenience and economy most of the dye trials are made upon small skeins or swatches of the required materials, but from time to time students are required to dye larger quantities in the full-sized dyeing machines.

413. Analytical Chemistry—3 Years.

Laboratory Work and Lectures in Quantitative Analysis.

Three nights each week of class-room and laboratory work.

The object of this course is to give the student a general idea of the underlying principles of Analytical Chemistry, with a sufficient amount of laboratory work to enable him to become proficient in performing the ordinary routine analysis of the textile plant. Frequent recitations are held for the discussion of methods and the solution of stoichiometrical problems.

The work covered the first two years is based on Smith's "Quantitative Analysis," and for the advanced work, consists of the analysis of soap, water, oils, coal and other materials of particular interest to the textile chemist. Special lecture notes are given and Griffin's "Technical Methods of Analysis" is used as a text.

414. Textile and Analytical Chemistry—4 Years.

Lectures in Textile Chemistry and Dyeing.

Laboratory Work in Analytical Chemistry.

Combines all lectures in Textile Chemistry and Dyeing with work of Course 413, but does not include any Dyeing Laboratory.

Three evenings each week.

415. Chemistry and Technology of Leather—1 Year.

Requirements: Two years of evening elementary chemistry and two years of inorganic quantitative analysis. A student without this preparative background or its equivalent will not be admitted to this course.

This is a one year course and treats of the chemistry and technology of leather manufacture. All the tannery processes are taken up with special emphasis on the purpose of each operation. In respect to the chemistry involved a short introduction to the chemistry of proteins and fats and the action of enzymes is presented, and the usual analytical methods are considered. Throughout the course mention is made of recent developments and fields of research.

The early part of the course consists entirely of lectures (three one-hour periods). The latter part consists of one weekly lecture and a two-hour laboratory session.

Two evenings each week.

ENGLISH DEPARTMENT

511. English Composition—2 Years.

First Year.—REMEDIAL ENGLISH AND RHETORIC.—In order to write well it is necessary to have a thorough understanding of grammar. Moreover, it is a great satisfaction to know why you are correct in speaking and writing in a certain way. This course is designed to give a comprehensive survey of necessary grammatical and rhetorical principles. The course of instruction consists of lectures, recitations, remedial exercises, and the study of a text book.

One evening each week.

Second Year.—THE PRINCIPLES OF COMPOSITION.—This is an advanced course and is not open to students who have not completed the first year or its equivalent. The primary purpose of this course is to give the student the ability to write clearly and correctly. An intensive study is made of the four divisions of composition—narration, description, exposition, and argumentation— and the art of letter writing. Selections from various authors to be read for general interest and for the purpose of illustration, are assigned for outside reading. Lectures are given; and home work, the study of a text book, and examinations are required.

One evening each week.

512. Appreciation of Literature—1 Year.

This subject is offered for those who wish to enlarge their cultural background and to study the principles of literary appreciation and criticism. Altho there will be emphasis upon literary technique, the constant aim will be to keep this subordinate to the spirit and the message of the selection.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical. Emphasis will also be placed upon the value of an extensive reading program. (This course will not be given if the registration is less than twenty-five.)

One evening each week.

TEXTILE ENGINEERING DEPARTMENT.

This department has arranged to offer those courses of study which lie at the foundation of all engineering. These are designed to give to those engaged in the mechanical, electrical, and manufacturing departments of mills, factories and other industrial establishments an opportunity to learn something concerning the theory underlying the many practical methods which they use in their daily work. Those subjects for which there is usually a regular demand are listed and described below, but similar and allied courses will also be arranged for provided there is a sufficient demand. In the case of all courses there must be an enrollment of at least ten properly qualified students to warrant giving the subject.

613. Mechanical Drawing—3 Years.

This course is a complete course in drawing and is offered for one having occasion to make a sketch or detail drawing for the purposes of illustration or instruction, or for one who is daily required to work from a drawing or blueprint. It first lays a foundation of the principles of mechanical drawing, and follows this with two years' work in drawing directly from parts of machines, preparing both the detail and the assembly drawing.

The work is so planned that at its completion a man shall be thoroughly familiar with the making of a working or shop drawing. After a study of the underlying principles of projections and instruction in penciling, inking, lettering and tracing, the subject of sketching and the making of detail drawings therefrom is especially stressed. The preparation of assembly drawings is finally considered.

Two evenings per week.

614. Machine Shop Practice—2 Years.

This course offers an opportunity to learn the art of metal working and is equally valuable to the man who already has some knowledge of the methods employed as

to one who has no knowledge of the same. Thus it becomes possible for one who may be working at the bench during the day to learn how to operate a lathe or other machine tool, or for a lathe hand to acquire a knowledge of a planer, shaper, milling machine, or grinder. A series of lectures is given on the care and management of tools, tool grinding, and the mechanism of the machines. A man who only has a knowledge of the special machine he operates may by means of this course become a more intelligent machinist. He should supplement this study with the courses in Mechanical Drawing, Shop Mathematics, Mechanics, and Mechanism, in order that his training for an all-round machinist or mechanic may be more complete.

Two evenings each week.

619. Mechanics—1 Year.

This is one of the most important of engineering subjects. Its principles are so fundamental and so widely used in more advanced subjects that the student should not consider himself qualified for further work until he has mastered the principles of this subject.

Beginning with a discussion of such important topics as work, power, horse-power, energy and the like, the student then studies the fundamental mechanical principles which are exemplified by the lever, jackscrew, pulley block, inclined plane, wedge, differential pulley and other similar devices. This is followed by consideration of the simpler relations pertaining to uniform and accelerated motion. No student should undertake this course who is not thoroughly familiar with elementary mathematics. This subject requires home problem work and the study of a text book.

Two evenings each week.

620. Mathematics—2 Years.

This course is designed to permit the student to pursue further the mathematics of his grammar or junior high school course, and should be taken by all who intend to study further into engineering subjects. The first year work in algebra includes addition, subtraction, multiplication, division, factoring and fractions. Some of the topics treated during the second year are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule and trigonometry. Instruction is largely through problem work in class and at home and requires the use of a text book.

Two evenings each week.

621. Strength of Materials—1 Year.

This interesting subject deals with those important principles whereby the person engaged in machine, engine, mill or building design may ascertain whether the parts are strong enough to carry the forces and loads which the nature of the construction imposes upon them.

The fundamental stresses of tension, compression and shear are first considered, together with the ultimate strength of cast iron, wrought iron, steel, and timber. The practical use of this information is illustrated in the design of bolts, tie rods, columns, wall piers, boiler shells, riveted joints, etc. This is followed by a study of the stresses in and design of beams under various conditions of loading, and the course concludes with a discussion of the torsional stresses and twist in shafts. A knowledge of the principles of Mechanics and Mechanism is highly desirable to a satisfactory understanding of this subject. The method of instruction is through lectures, recitations, problems, and the use of a text book.

Two evenings each week.

622. Steam—1 Year.

It is the purpose of this course to study the various methods of heat generation, transmission, and utilization in use at the present day and to learn the theoretical relationship which underlie these processes and transformations.

The instruction covers, so far as time permits, the elements of steam engineering. The topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, together with a study of the methods of testing the various types of apparatus. Actual tests on such equipment are made as the size of the class permits. Text books, laboratory and class work, and home problems are the methods of instruction used.

Two evenings each week.

623. Direct Current Electricity—2 Years.

This popular course is planned to cover the fundamentals of direct current circuits and machinery. The lectures on electrical theory are supplemented by laboratory work and the use of a text book and problems. A considerable amount of home study and preparation is required. Students who wish to take this subject must have studied one year of algebra.

The fundamental properties of electrical and magnetic circuits are studied both in the classroom and laboratory. Other topics include the measurement of resistance, the calculation and measurement of power in direct-current circuits, and the relation between the electrical, heat and mechanical units of energy. A large amount of laboratory and class work is given to make the student familiar with methods of operation, testing and control of direct current machinery.

Two evenings each week.

624. Alternating Current Electricity.—2 Years.

This course is similar to Course 623 except that it deals with alternating current circuits and machinery. No student should plan to take this course unless he has previously taken at least one year of Course 623 or can show that he has had the equivalent.

The fundamental properties of alternating current circuits are first considered, and are followed by a study of the operation of alternating current machinery. The study of electrical measuring instruments is also included in this course. The instruction is given by means of lectures, recitations, and a large amount of laboratory work.

Two evenings each week.

625. Power Plant Machinery—1 Year.

The purpose of this course is to teach the operating engineer how to test the various units usually found in a power plant. Numerical calculations are introduced and the interpretation of the results is of primary importance.

The following are some of the machines tested: engine, turbine, triplex pump, centrifugal pump, injector, etc. Various gages are also calibrated. A text book is required.

Two evenings each week.

626. Mill Illumination—1 Year.

Safety and production, factors entering into the design of lighting installations, industrial codes, costs and estimates are carefully considered. The laboratory exercises include the study of photometric curves of industrial units, study and use of the photometer, study of illumination by means of the Macbeth Illuminometer, and foot-candle meter.

The concluding work will be the complete design of a lighting installation, using the Institute laboratories or a local mill room.

Owing to limitations in apparatus, this course is open to a limited number of qualified men.

Two evenings each week.

628. Selling and Advertising—1 Year.

This course covers the basic principles of both salesmanship and advertising. Problems on the construction of individual advertisements, selling talks, and the planning of advertising campaigns, give the student an opportunity to put into practice the principles covered in the lectures.

The psychology of selling and advertising, copy writing, layout, printing and engraving, illustrations, testing of advertising, advertising campaigns, building a selling talk, retail salesmanship, and showmanship are some of the topics treated.

Two evenings each week.

630. Mechanism—1 Year.

This course deals with those principles and elementary mechanism which are used in the transmission of motion through machines and mechanical devices. It requires a knowledge of the principles developed in "mechanics" and hence can be taken only by qualified students. The instruction includes pulleys, belting, gears, gearing, cams and similar topics. Home problem work and the study of a text book are required.

Two evenings each week.

631. Plane Geometry—2 Years.

In this course the usual theorems and constructions of good text-books are studied. The topics include the properties of plane rectilinear figures, the circle and measurement of angles, similar polygons, areas, regular polygons and the measurement of the circle. Solutions of original exercises and applications of geometry in calculation of angles, areas, and lines will also be given. Assignments for home study will be made.

Two evenings each week.

632. Diesel Engines—1 Year.

The object of this course is to present an elementary study of Diesel engines, their operation, and maintenance. The subjects studied include—the various forms of Diesel engines in general, two and four cycle, semi-Diesel, etc.; a comparison between gasoline and oil engines; fuel oils—heat value, properties; fuel injection systems—control, timing, distribution; combustion—efficiency, control, products; engine parts and their functions—assembly, clearances, wear; lubricating oils—properties, filtration; cooling systems—heat transfer, radiation; air intake and exhaust systems—supercharging, silencing, heat recovery; starting systems—air, electric, gasoline; engine installations—vibration; engine applications—mobile, stationary; and maintenance in general for an entire power plant.

No student should undertake this course who is not familiar with elementary physics and mathematics, as considerable time will be spent on the materials used and the reactions involved in an internal combustion engine. The subject requires home problem work, study of a text book, and examination at the end of each term.

Two evenings each week.

633. Shop Mathematics—1 Year.

This subject deals with the practical application of mathematics which is of the greatest use to machinists or those in similar lines of work. It consists of those parts of arithmetic, algebra, geometry and trigonometry, which are essential in modern machine shop practice. Some of the topics are:—fractions and decimals, logarithms, problems in ratio and proportion, areas of surfaces, calculation of angles, solution of right and oblique triangles.

In addition to the mathematical work, the scientific principles which govern the operation of various machines are studied. In this connection the following topics are included:—verniers and micrometers, levers, belt and gear speeds, screw threads and screw cutting, gear tooth computations, plain and differential indexing. This subject requires home problem work and the study of a textbook.

Two evenings each week.

634. Air Conditioning—2 Years.

The subjects covered in this course include the following; fundamental laws, principles and definitions; physical properties of the atmosphere; explanation of words and terms used, such as—matter, energy, heat, heat energy, temperature, ice, water, vapor, gas, steam, thermometers, hygrometers, hydrometers, barometers, pressure, gage pressure, absolute pressure, absolute temperature, laws of gases, heat units, vapor pressure, dew point, evaporation, condensation, precipitation, relative and absolute humidity; sensible heat, latent heat, specific heat, total heat of air, effective temperature, comfort zones, air movement, ventilation; movement of heat and air, infiltration, conduction, solar heat, air leakage; heat from human beings; lights, machinery and processes; humidification and dehumidification, heating and cooling, air filtration, air washing; refrigeration and refrigerants, cooling by water, ice, typical air-conditioning equipment, typical control equipment, thermostats, humidostats, wet and dry bulb type; use of charts and tables, costs, etc.

Students are required to hand in complete details for producing prescribed conditions of temperature and humidity in some building in or near Lowell, Mass., before completing the course.

One evening each week.

635. Practical Electricity—1 Year.

The purpose of this course is to aid students who wish to advance themselves in any one of the electrical trades. The course will cover the underlying facts and laws of good electrical practice which the really well-informed and efficient workman must understand.

Lectures will be given one night each week on the following subjects: the nature of magnetism, Ohm's Law, simple electric circuits, combinations of series and parallel systems, wiring diagrams, electric bulbs and telephones. The practical part of the course, given one night each week, is divided into several experiments which will give the student a working knowledge of electrical wiring and installations.

Two evenings each week.

Accounting Classes (Division of University Extension)

Classes in Elementary, Advanced and Cost Accounting have been offered in past years at the Lowell Evening Textile School under the auspices of the Division of University Extension, State House, Boston, Mass. Their continuance is dependent upon a sufficient expression of interest in them. Outlines of the courses, fees, etc., may be obtained by inquiry at the above address or by addressing the school.

FINISHING DEPARTMENT.

In this course machine work is supplemented by lectures and discussions pertaining to the many finishes given to fabrics. The action of soaps, water, steam, heat and cold upon cloth containing one fiber or combination of fibers as used in commercial fabrics is carefully studied. This course also helps the finisher to broaden his knowledge of textile fabrics.

710. Woolen and Worsted Finishing—1 Year.

The outline of this course, which is given chiefly by means of lecture work, is as follows:

Burling and Mending.—Under this head are taken up for consideration the examination of flannel as it comes from the loom; the construction, use and location of the perch; the methods used in marking defects, measuring, weighing and numbering of cloths; also the methods of inspection for fancies, single cloths and double cloths. The object of burling, mending and the types of tables employed, the method of removing knots, runners, etc., the object of back shearing and the use of burling irons, the replacing of missing threads and the importance of sewing as a part of the finishing process, are also considered in detail. The removal of oil and tar spots as well as stains of various kinds is studied.

Fulling.—This branch covers a study of the conditions of the flannel as it comes from the loom, and the influence of oil, etc., upon the procedure. Considerable time is devoted to the various methods of producing a felt, the various types of stocks and their modifications and development into the present type of rotary fulling mills of both single and double variety. The details of construction in all machines are carefully taken up and include the design and composition of the main rolls, method of covering, regulation and means of adjusting the pressure of traps and rolls, and the use and regulation of the various types of stopmotion, the different types of stretchers, guide rolls and throat plates.

The theory of felt is taken up and the influence of pressure, moisture, heat, alkali and acid is considered, as well as the hydroscopic and felting properties of different wool fibers. The preparation of the flannel for the mill and the usual methods of determining shrinkages, as well as the various methods of soaping, are given careful attention. The preparation of various fulling soaps and the value of each for the production of various degrees of felt, as well as the determination of the proper amount of alkali for various goods, are carefully studied and demonstrated. The manipulation of the various kinds of goods in the mill, viz., all wool, reworked wools and mixed goods, is studied in classroom and by operation in the laboratory.

The change in weight and strength for each operation is carefully considered, as is also the value of the flocks made in each. A study of the various methods of flocking, such as dry and wet, is considered in both class and machine rooms. In each operation the defects likely to materialize are studied, as well as the cause thereof, and various methods of modifying or lessening them.

Washing and Speck Dyeing.—This branch considers the scouring, rinsing and washing of goods before and after the fulling process; the various types of washers; and the details of construction, such as suds box, rolls, etc. The theory of scouring, uses of Fuller's earth, salt solutions and sours on the different kinds of goods are made clear by practical work in the machine room, where the effects due to improper scouring, such as stains, cloudy effects wrinkles and unclean goods,

are demonstrated. The discussion of the necessity of speck dyeing follows naturally from the study of these matters, and includes methods of preparation, materials used, application and tests required.

Carbonizing.—This is an important branch of finishing, and includes a study of the various carbonizing agents, methods of application, strength of solutions and neutralizing, as well as the machines used. Stains and imperfections resulting from carbonizing are also considered. The drying and tentering machines and extractors employed are taken up at this point.

Gigging, Napping and Steaming.—The construction in detail of the various types of gigs, nappers, steamers, wet gigs, rolling, stretching, crabbing and singeing machines is discussed, and their actions upon the cloth and the results obtained are explained.

Various methods of obtaining luster and the production of permanent finish are considered in connection with steaming and sponging.

Brushing, Shearing and Pressing.—This includes, as do the other branches, a careful treatment of the machine employed, the preparation of the cloth for each process, the action of each machine in producing its part of the resultant effect. In the manipulation of the shear consideration is given to its setting, grinding and adjustment. With the brushing machine the effect of steaming and moisture upon the luster and feel of the goods is shown. A study of the action of the presses, both plate and rotary, involves consideration of pressure, steaming, etc. Special processes to obtain particular effects are taken up, and the part played by each machine is explained. The details involved in handling cloth on a commercial scale, as, for example, measuring, weighing, ticketing, numbering and rolling, are also explained. The necessary calculation and the methods of finishing all grades of goods are considered from time to time during the year.

Two evenings each week.

EVENING GRADUATES OF 1941.

Certificates awarded as follows, April 9, 1941:

Cotton Yarns—Two Years

Bernard Francis Brady, Jr., Lowell
Klemants Joseph Shishlo, Nashua, N. H.
Howard Earle Smith, Nashua, N. H.

Knitting—One Year

Alfred Joseph Lajeunesse, Lowell
Wilfrid Benjamin Lajeunesse, Lowell
William Gulliver Sheldon, Boston
Norman Harold Thrope, Lowell

Wool and Top Making—One Year

Theodore Cuyler Ackroyd, Jr., Methuen
Tom Ramsden Birch, Methuen
Niall Orrin Fleming, Methuen
Fred Dawson Ingle, Methuen
Henry Walter Narushof, Lawrence
Alberton Vinal Olsen, North Chelmsford
James Thomas Olsen, Lawrence
James Wilson Pringle, Lawrence
Ben Shinner Riley, North Andover
Thomas Fred Rushton, Methuen
Ernest Francis Stokham, Lowell
Charles Henry Turner, North Andover
Ralph Howard Winslow, Ayer
Sidney Robert Wordsworth, Hudson

Woolen Yarns—One Year

Chester Robert Bell, Lowell
Arthur Bernard Charlesworth, Methuen
Edward Cooper Clarenbach, North Andover
Peter Hayden Clark, Lowell
Harold Earl Knight, Lowell
Stefan Kuzmitski, Methuen
Walter Stoddart MacLauchlan, Methuen
Harry Edwin Mason, Lawrence
Edward Fred Miller, Lawrence
Anthony Peter Stawasz, Nashua, N. H.

Worsted Yarns—One Year

Edward Paul Law, Worcester
Norman Ingalls Midgley, Lowell
John Harvey Ramsey, North Chelmsford
William Plunkett Rockwell, North Andover

Cotton Design—Three Years

Norman Leonard Courtemanche, Manchester, N. H.
Walter Lacheta, Manchester, N. H.
Louis Philip Pellerin, Lowell

Woolen and Worsted Design—Three Years

Louis Charles Broughton, Andover
William Gerald Casey, West Concord
Horace Milton Culpon, Jr., North Andover
George William Daley, Haverhill
John Augustine Delaney, Lawrence
Harry Ford, Lawrence
David Gardner Grady, North Billerica
John Henry Hargreaves, Methuen
Freeman Clark Hatch, III, North Andover
David Williamson Lawrie, Lawrence
George Aloysius O'Brien, Lawrence
Lawrence Ervin Thompson, Haverhill

Show Card Design—Two Years

Marcel Romeo Frechette, Lowell
Russell Irving Mattheson, Lawrence
Albert Ogden Pardoe, Lowell
Joseph Domingos Pereira, Jr., Lowell

Decorative Art—Three Years

Helen Louise Cleary, Lowell
Philip Eugene Colburn, Jr., Lowell
Pauline Marie Drouin, Lowell
Roselda Harnois, Lowell
Gertrude Genevieve Longval, Lowell
Helene Jeanne Martin, Lowell
Regina Blanche Moberg, Lowell
Winifred Keyes Notini, Lowell
William Benedict Welsh, North Billerica

Loom Fixing—One Year

Harry John Barraclough, Lawrence
John Alfred Blinn, Methuen
Frederick John Duckett, Lawrence
Raymond Maxime Lafortune, Lowell
Walter Joseph Molda, Lowell
Henry Leo Paradis, Lowell
Chester Arthur Riley, Methuen
Thomas Francis Sweeney, Lowell

Woolen and Worsted Weaving—One Year

Raymond Arthur Bardsley, Methuen
George Edwin Clayton, Gleasondale
Arthur Robert Clinton, Methuen
Robert Vincent Cote, Lawrence
Frederick John Duckett, Lawrence
Edward Lorenzo Hapshe, Lawrence
Edward Francis Keough, Hudson
Peter Kiberstis, Methuen
Edmond Henry Letendre, Lowell
Robert Townsend Lewis, Chester, N. H.
Paul Muskavitch, Lawrence
Lucille Loretta Pariseau, Lowell
Henry Andrew Strok, Lowell
Joseph Isidore Trudel, Lowell
Leonard George Tuminowski, Methuen

Woolen and Worsted Finishing—One Year

James John Caires, Cambridge
Guy Sargent Haynes, Haverhill
Herman Alfred Heinrich, Jr., Methuen
Norman Stewart Lawn, Lawrence
Harold McAllister, North Andover
Arthur Edward Manson, Dorchester
John Frederick Moroche, Methuen
Robert Howes Proctor, Andover
Axel Victor Swanson, Lowell

Appreciation of Literature—One Year

Sarah Berg, Lowell
Veronica Catherine Brosnan, Lowell
Teresa Florence Coffin, Lowell
Patricia Agnes Malone, Lowell
Deme Patsourakos, Lowell
Ruth Evelyn Robinson, Lowell

English Composition—Two Years

Irene Mary Anne Bellemare, Lowell
Genevieve Mary Carney, Lowell
Helena Joan Fish, Lowell
Edward George Haines, Chelmsford
Patricia Agnes Malone, Lowell
Eleanor Ann Murphy, Lowell
Olga Helen Piekarski, Lowell
Jeanne Antoinette Prud'homme, Lowell
Margaret Cordelia Smith, Lowell
Louis Albert Tousignant, Lowell
Hazel Ruth Young, Lowell

Textile Chemistry and Dyeing—Three Years

Joseph Harper Binns, North Andover
Chester Burton Brown, Methuen
Harold Albert Bryant, Jr., Methuen
Richard Stearns Bunting, Methuen
Harvey George Gendreau, Lowell
Gilbert Oscar Just, Methuen
Kenneth Raymond Morley, Methuen
Charles William Saalfrank, North Andover
Robert Winslow, Salem Depot
Walter Benjamin Worsman, North Andover

Analytical Chemistry—Three Years

Joseph Edward Reidy, Lowell

Elementary Chemistry—Two Years

James Maurice Brock, Manchester, N. H.
Thomas Edward Clark, Jr., Lowell
Joseph John Coletta, Lawrence
William Arthur Daniels, Jr., Salem
Albert Joseph David, North Billerica
Arthur Malcolm Dryden, Ashland
Allen Louis Gesing, North Andover
Bert Gilbert, Methuen
Russell Bigelow Lisle, Jr., Lowell
Jane Loretta McLaughlin, Lawrence
Ann Mary Manchenton, Lowell
Robert Edwin Mann, Methuen
Jeremiah Joseph Murphy, Jr., Lawrence
Eugene John O'Neil, Lawrence
Kenneth Guy Pentheny, Hopkinton
William Stanley Shires, Lowell
Everett Ernest Smythe, Lawrence
Richard Clement Starke, Methuen
Walter Edward Taylor, Lawrence
William Thomas Vetter, Jr., Lawrence
William Joseph Wyskoczka, Lowell

Mechanical Drawing—Three Years

Harold Albert Arnold, Methuen
Frederick Paul Bohne, Methuen
John William Cassin, Lowell
Raymond Horace Gauthier, Lowell
John Robert Hammersley, Lowell

Direct Current Electricity—Two Years

Albert Allen Denio, Lowell
Frederick Francis Greaves, Lowell
Henry Thomas Greaves, Lowell
Robert George Hewson, Methuen
Michael Joseph Iannazzi, Lawrence
John Maurice Iversen, Lowell
Charles Michael Kaslow, Methuen
Raymond Irving Lambert, Methuen
John Warren Martin, Lowell
Hugh Raymond Rogers, Jr., Lowell

Alternating Current Electricity—Two Years

Fred Thurlow Goodwin, Jr., Hudson, N. H.
Louis Joseph Greaves, Lowell
Albert Peter Manzi, Lawrence
Joseph Peter Mazga, Lowell
Melvin Wilbur Newton, Chelmsford
Herbert Hodgson Robinson, Harvard

Practical Electricity—One Year

William Bernhardt, Methuen
Arnold Wesley Bilodeau, Haverhill
Armand Joseph Caron, Lowell
Jean Joseph Doucette, Lowell
Gerard Joseph Dupre, Lowell
Donald Joseph FitzGerald, Lowell
Leo Armand LeBlanc, Nashua, N. H.
George Prichard Maclaren, Jr., Tewksbury
Charles Gavan McClure, Lowell
Paul Francis Molloy, Lowell
Raymond Arthur Neville, Lawrence
Norman Otis Wright, North Chelmsford
Maurice Zall, Lowell

Steam—One Year

Arthur Raymond Burke, Lowell
Francis Patrick Callahan, Lowell
William John Harnedy, Lawrence
Frank Joseph Shore, Lowell
Walter Joseph Wilson, Lowell

Air Conditioning—Two Years

David Albert Constantine, Chelmsford
Donald McKeown, North Billerica

Machine Shop Practice—Two Years

Edward Desmarais, Lowell
David Dominic Ebacher, Amesbury
Ernest Louis Harnois, Lowell
Theodore William Leon Harnois, Lowell
Alexander Nicholas Hetman, Lawrence
Charles Bernard Hyde, Lowell
Donald Leigh Knight, East Chelmsford
Henry Anthony Lis, Lowell
Edwin Robinson McLoon, Lowell
Edward Francis Mickolus, Lawrence
Coburn Mirfield, Methuen
Raymond Royal Paquin, Dracut
Daryl Victor Pleshaw, Methuen
Harold Arthur William Stacy, Lawrence

Diesel Engines—One Year

Leo Nicholas Alexakos, Dracut
Evan Lewis Caraganis, Dracut
Philip John DiDio, Lawrence
Raymond Elgin Emmert, Lawrence
James Francis Gardner, Lowell
William Maguire, Lowell
Vernon Burke Morris, North Chelmsford
Joseph Michael Thomas Mullen, Lowell
Thomas Joseph Nicolosi, Lawrence
John Scott, Lowell
Vito Joseph Vidunas, Lawrence
John Francis Welch, Jr., Lowell

Selling and Advertising—One Year

William Edward Andrews, North Andover
Henry Daniel Audesse, Andover
Harry Francis Bean, Lowell
Mary J. Betses, Lowell
Anne Catherine Buckley, Lowell
Fred Augustine Butterworth, Jr.
Arthur Peter Contos, Lowell
Edward Bernard Devlin, Lowell
George Elias Eliopoulos, Lowell
James Paul Etchells, North Andover
Pauline Alice Dumont, Lowell
Arthur Theodore Hamilton, Lowell
William Joseph Hynes, Methuen
Ernest Gage Johnson, Nashua, N. H.
Francis Joseph Mahoney, Methuen
Maurice Gordon Phillips, Lowell
James Woodbury Scribner, Andover
Angley Solomonides, Lowell
Louis Stavropulos, Lowell
Victor Carlixte Tetreault, Lowell
John Wesley Trubey, North Chelmsford
Vasilo Zouvelos, Lowell

Mechanics—One Year

Gerard Louis D'Amour, Lowell
Walter Joseph Deputat, Lowell
George Alvida LaRoche, Methuen
Robert Emery Paquin, Lowell
John Joseph Smith, North Chelmsford

Mathematics—Two Years

Edward Paul Boucher, Wamesit
Roland Stuart Johnson, West Chelmsford
Xenophon Dionysius Michopoulos, Lowell
Nicholas Andrew Natsios, Lowell
Lucien Maxime Poirier, Lowell
George Hyde Waterhouse, Lowell
Bernard Francis Welch, Lowell
Charles Bernard Wilson, Methuen

Shop Mathematics—One Year

Philip Irving Collins, North Billerica
Henry Joseph Cormier, Jr., Westford
Peter Nicholas Dadasis, Lowell
Earle Stewart Dickinson, Lowell
Albert Paul Ebacher, Amesbury
Ernest Flory, Lowell
Paul Giguere, Lowell
Edward Arthur Hebert, Lowell
James Shields Johnston, Lowell
James Henry Keenan, Lowell
John Kohanek, Lowell
Walter John Kohanek, Lowell
Joseph Edmund Landry, Pelham, N. H.
Paul Joseph Landry, Lowell
Russell Roland LaFleur, Lowell
Paul Rene Lemire, Lowell
Joseph Michael McNulty, Lowell
Robert Richard Proulx, Dracut
Lincoln Albert Riggs, Littleton
Donald Leigh Knight, East Chelmsford